

# STANLEY COBB SOLOMON

## CURRICULUM VITAE

Stan Solomon is a scientist at the National Center for Atmospheric Research, High Altitude Observatory, specializing in the physics and chemistry of the upper atmosphere and ionosphere. He received the A.B. from Harvard College, and the M.S. and Ph.D. from the University of Michigan. His dissertation research was on tomographic methods for analysis of satellite measurements of the aurora. After receiving the Ph.D. in 1987, Solomon studied auroral physics and upper-atmosphere modeling as a post-doctoral visiting scientist at NCAR. In 1990, he moved to the University of Colorado, Laboratory for Atmospheric and Space Physics, where he conducted chemical modeling and electron transport theory studies, and participated in the CU solar/airglow rocket program. In 1993, he was named an Interdisciplinary Scientist for the NASA Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, and in 1995, he became the Deputy Principal Investigator and Project Manager of the Student Nitric Oxide Explorer (SNOE), a small satellite constructed at the University of Colorado. He also taught several graduate seminars at the University of Colorado on topics ranging from solar-terrestrial physics to satellite system design, and supervised Ph.D. and Masters students. In 2000, Solomon returned to NCAR, and was appointed a Senior Scientist in 2006. He was the Deputy Director of the High Altitude Observatory from 2005 to 2009, served as its Acting Director from October 2009 through June 2010, and now leads the Geospace Frontiers section. He is currently working on upper-atmosphere model development, the effects of solar and geomagnetic variability, and airglow simulations for the Global-scale Observations of the Limb and Disk (GOLD) mission. Solomon has authored or co-authored over 200 scientific papers, and has also written articles for the public. He has been on numerous committees for NASA and the National Science Foundation, and served as the Secretary for Aeronomy of the American Geophysical Union.

### EDUCATION

- |      |   |
|------|---|
| 1987 | Ph.D. (Atmospheric Science), The University of Michigan, Ann Arbor, Michigan    |
| 1982 | M.S. (Atmospheric Science), The University of Michigan, Ann Arbor, Michigan     |
| 1975 | A.B. (Psychology & Social Relations), Harvard College, Cambridge, Massachusetts |

### APPOINTMENTS

- |              |   |
|--------------|---|
| 2017–Present | Section Head, Geospace Frontiers, High Altitude Observatory, National Center for Atmospheric Research |
| 2006–Present | Senior Scientist, High Altitude Observatory, National Center for Atmospheric Research                 |
| 2009–2010    | Acting Director, High Altitude Observatory, National Center for Atmospheric Research                  |
| 2005–2009    | Deputy Director, High Altitude Observatory, National Center for Atmospheric Research                  |
| 2001–2006    | Scientist III, High Altitude Observatory, National Center for Atmospheric Research                    |

- 2000–2001 Project Scientist III, High Altitude Observatory, National Center for Atmospheric Research
- 1994–2000 Lecturer, Astrophysical and Planetary Sciences Department, University of Colorado
- 1990–2000 Research Associate, Laboratory for Atmospheric and Space Physics, University of Colorado
- 1987–1989 Post-Doctoral Visiting Scientist, High Altitude Observatory, National Center for Atmospheric Research
- 1987 Research Fellow, Space Physics Research Laboratory, The University of Michigan

## COMMUNITY SERVICE

### Professional Service

- 2019 Guest Editor, “Initial Results from the Global-scale Observations of the Limb and Disk Mission,” *Journal of Geophysical Research*
- 2018 Scientific Organizing Committee, TREND-2018 Meeting, Hefei, China
- 2017 Lead Convener, Neutral Density and Orbit Determination Working Group, NASA Community Coordinated Modeling Center Workshop
- 2016 Chair, Scientific Organizing Committee, NSF-ICON-GOLD Workshop
- 2016 Lead Convener, TIE-GCM Users Group Workshop, CEDAR Summer Meeting
- 2015–2016 Scientific Organizing Committee, TREND-2016 Meeting, Kühlungsborn, Germany
- 2014 Steering Committee, NASA Living With a Star Institutes
- 2014 Program Committee, NASA Living With a Star Workshop
- 2013–Present Task Group Lead, Role of the Sun and Middle Atmosphere in Climate program.
- 2013 Guest Editor, “Causes and Consequences of the Extended Solar Minimum between cycles 23 and 24,” *Journal of Geophysical Research*
- 2013 Lead Convener, “New Observations of the Thermosphere-Ionosphere,” American Geophysical Union Fall Meeting
- 2013 Program Committee, Next-Generation Suborbital Researchers Conference
- 2013 Scientific Committee, Chapman Conference on the Causes and Consequences of the Solar Minimum between cycles 23 and 24
- 2012–2015 Suborbital Applications Research Group, Commercial Spaceflight Federation
- 2012 Local Organizing Committee, HEPPA/SOLARIS Workshop
- 2010–2011 Steering Committee, NASA Living With a Star Targeted Research and Technology Program
- 2011 Guest Editor, “Dynamic Coupling Between the Earth’s Atmospheric and Plasma Environments,” *Space Science. Reviews, Volume 168*
- 2010 Co-Convener, Session SA11 “Heliosphere-Atmosphere Coupling and Climate,” American Geophysical Union Fall Meeting
- 2010 Local Organizing Committee, TREND-2010 Meeting
- 2009–2010 Conveners Committee, “Coupling Between the Earth’s Atmospheric and Plasma Environments,” International Space Sciences Institute, Bern, Switzerland

2009 Local Organizing Committee, High Energy Particle Precipitation in the Atmosphere (HEPPA) Workshop

2008–2014 Management Operations Working Group, NASA Geospace Program

2008–2010 Ad Hoc Steering Committee, Ionosphere-Thermosphere-Mesosphere Research

2008 Main Session Organizer, 7<sup>th</sup> Thermospheric/Ionospheric Geospheric Research (TIGER) Symposium, COSPAR meeting, Montreal, Canada

2008–2011 Focused Science Team Leader, Ionosphere-Thermosphere Variability, NASA Living With a Star program

2008–2009 Mission Planning Working Group, NASA Heliophysics program

2007–2008 Management Operations Working Group, NASA Living With a Star program

2007 Co-Chair, Local Organizing Committee, Living With a Star Science Workshop

2006–2007 Steering Committee, NASA Living With a Star Targeted Research and Technology program

2005 Co-Convener, Sessions SA32A “Global Change in the Upper Atmosphere” and SA51A “Solar EUV and X-ray Effects on Planetary Atmospheres,” American Geophysical Union Spring Meeting

2004 Organizing Committee, 5<sup>th</sup> Thermospheric/Ionospheric Geospheric Research (TIGER) Symposium, COSPAR meeting, Paris, France

2002–2004 Secretary for Aeronomy, SPA Section, American Geophysical Union

2002 Program Committee, Fall Meeting, American Geophysical Union

2001 Organizing Committee, 3<sup>rd</sup> Thermospheric/Ionospheric Geospheric Research (TIGER) Symposium

2000 Guest Editor, Theory and Modeling, TIGER Proceedings, *Phys. Chem. Earth*

1999 Organizing Committee, 2<sup>nd</sup> Thermospheric/Ionospheric Geospheric Research (TIGER) Symposium, St. Petersburg, Russia

1999 Co-Convener, Session SA51A “Direct Sampling in the Ionosphere,” American Geophysical Union Fall Meeting

1998–2000 AGU Space Physics and Aeronomy Student Awards Committee

1998 Lead Convener, Session SA42A “Odd Nitrogen in the Upper Atmosphere,” American Geophysical Union Fall Meeting

1998 Launch Vehicle Interface Working Group, Universities Space Research Association

1998 Organizing Committee, 1<sup>st</sup> Thermospheric/Ionospheric Geospheric Research (TIGER) Symposium, Freiburg, Germany

1997 Advisory Committee, University of Colorado Heritage Center

1997 NASA International Consultative Group

1997 Convener, Session 2.3 “Auroral Spectroscopy,” IAGA Meeting

1996–1998 NASA Geospace Multiprobes Science Definition Team

1996 Organizer, Auroral Arcs Workshop, CEDAR Workshop

1995–1998 CEDAR/TIMED Collaborative Science Coordination Committee

1993–2007 Science Working Group, NASA TIMED Mission

1993–1998 Science Team, Arizona Imaging Spectrograph STS Experiments

1993–1994 Phase I Study Team, ESA ATON Mission

1993 Local Organizing Committee, Division for Planetary Sciences annual meeting  
 1992–1996 Steering Committee, Multi-Station Auroral Spectroscopy Campaign  
 1991–1994 Sun-Earth Environment Exhibits Committee, National Science Foundation  
 1990–2006 EUV Working Group, Solar Electromagnetic Radiation Study  
 1989–1991 Steering Committee, CEDAR/DE Lower Ionosphere Thermosphere Experiment  
 1989–Present Proposal Reviewer for the National Aeronautical and Space Administration and the National Science Foundation  
 1985–Present Referee for *Advances in Space Research*, *Annales Geophysicae*, *Canadian Journal of Physics*, *Geophysical Research Letters*, *Journal of Atmospheric and Solar-Terrestrial Physics*, *Journal of Geophysical Research*, *Nature Communications*, *Planetary and Space Sciences*, *Reviews of Geophysics*, *Space Science Reviews*, *Space Weather*

### Management Activities

2019–Present Appointments Review Group, NCAR  
 2018–Present Co-Chair, Director’s Advisory Committee, NCAR High Altitude Observatory  
 2016–Present Visitors Committee, NCAR High Altitude Observatory  
 2012–2015 Appointments Review Group, NCAR  
 2009–2010 Executive Committee, NCAR  
 2007–2010 Appointments Review Group, NCAR  
 2006–Present Appointments Committee, NCAR High Altitude Observatory  
 2005–Present Director’s Advisory Committee, NCAR High Altitude Observatory  
 2005–2009 Chair, Computer Advisory Group, NCAR High Altitude Observatory  
 2003 Scientist I Selection Committee, NCAR  
 2002–2013 Co-Director for Ionosphere-Thermosphere, Center for Integrated Space weather Modeling (a NSF Science and Technology Center led by Boston University)  
 2001–2005 Instrumentation Group Advisory Committee, NCAR High Altitude Observatory  
 2001–2002 Project Scientist / Associate Scientist Review Committee, NCAR  
 2000–2005 Deputy Science Manager, TIMED Doppler Imager, NASA  
 1999–2000 Interactions Committee, Aerospace Department and Laboratory for Atmospheric and Space Physics, University of Colorado  
 1998–1999 Student Concerns Committee, Laboratory for Atmospheric and Space Physics, University of Colorado  
 1998 Practicum Committee, Department of Astrophysical and Planetary Sciences, University of Colorado  
 1997–2000 Projects Steering Committee, Laboratory for Atmospheric and Space Physics, University of Colorado  
 1996 Strategic Planning Committee, University of Colorado  
 1995–2000 Deputy Principal Investigator and Project Manager, Student Nitric Oxide Explorer satellite, University of Colorado / USRA / NASA  
 1995–2000 Executive Committee, Laboratory for Atmospheric and Space Physics, University of Colorado

1990–1994 Computer Policy Committee, Laboratory for Atmospheric and Space Physics, University of Colorado

### **Educational Activities**

2019–2020 Dean, Space Weather Summer School, NCAR High Altitude Observatory

2018 Member of Ph.D. Committee, Jian Zhao, Aerospace Engineering Sciences Department, University of Colorado

2018 Chair of Ph.D. Committee, Tong Dang, School of Earth and Space Sciences, University of Science and Technology of China

2013–2019 Lecturer, Space Weather Summer School, NCAR High Altitude Observatory

2014–2015 Supervised post-doctoral research, Justin Yonker, NCAR High Altitude Observatory

2012–2014 Supervised post-doctoral research, Roger Varney, NCAR High Altitude Observatory

2008–2015 Lecturer, Heliophysics Summer School, Boulder, Colorado

2007–2009 Supervised post-doctoral research, Xiaoli Luan, NCAR High Altitude Observatory

2007 Supervised graduate research and member of Ph.D. Committee, Liying Qian, Department of Meteorology, Pennsylvania State University

2006–2007 Supervised post-doctoral research, Zhen Zeng, NCAR High Altitude Observatory

2005–2007 Supervised post-doctoral research, Jiuhou Lei, NCAR High Altitude Observatory

2005–2007 Supervised post-doctoral research, Geonhwa Jee, NCAR High Altitude Observatory

2003–2005 Supervised post-doctoral research, Naomi Maruyama, NCAR High Altitude Observatory

2002–2005 Supervised graduate research, Alexey Semenov, NCAR High Altitude Observatory and St. Petersburg University

2001–2012 Lecturer, Space Weather Summer School, Boston University

2000 Lecturer, Astrophysical and Planetary Sciences 5835, “Solar Influence on the Earth’s Climate?,” University of Colorado

2000 Member of Ph.D. Committee, Michael Moreau, Aerospace Engineering Sciences Department, University of Colorado

1999 Advisor and Chair of Ph.D. Committee, Steven M. Hill, Astrophysical and Planetary Sciences Department, University of Colorado

1998 Lecturer, Aerospace Engineering Sciences 5519, “Satellite Design for Low-Earth Orbit,” University of Colorado

1995 Lecturer, Astrophysical and Planetary Sciences 5000, “Sun-Earth Connections,” University of Colorado

1995 Member of Ph.D. Committee, Scott M. Bailey, Astrophysical and Planetary Sciences Department, University of Colorado

1994–1997 Lecturer, Aerospace Engineering Sciences 4519, “Student Explorer Satellite Project,” University of Colorado

- 1992 Chair of Comps II Examination Committee, Scott M. Bailey, Astrophysical and Planetary Sciences Department, University of Colorado
- 1990–2018 Assisted many additional Ph.D. students, including: Joan Alexander (University of Colorado), Clayton Cantrall (University of Colorado), Monica Coakley (University of Wisconsin), Freddy Cruz (University of Colorado), Tsu-Wei Fang (National Central University Taiwan), Xiaohua Fang (University of Michigan), Matthew Harris (University College London), Brooke Hatfield (University of Arizona), Timothy Holden (University of Colorado), Edward Hume (University of Michigan), Redgie Lancaster (Boston University), Ryan McGranaghan (University of Colorado), Aimee Merkel (University of Colorado), John Noto (Boston University), Erica Rodgers (University of Alaska), Brad Sandor (University of Colorado), Anke Schlesier (University of Gottingen), Donald Schmit (University of Colorado), Joshua Semeter (Boston University), Thomas Stone (University of Arizona), John Worden (University of Colorado)
- 1990–2000 Supervised numerous undergraduate and masters-level graduate research assistants in the CU Aerospace Engineering Sciences Department, including project supervision for M.S. students John Fulmer and Christopher Zeller
- 1990–2018 Various guest lectures in University of Colorado courses
- 1990–2018 Various lectures, tours, and public outreach activities, including Boulder Valley elementary schools, Denver Museum of Natural History, NCAR COMET program, global change workshop, and ASP colloquia

### **Professional Affiliations**

American Association for the Advancement of Science  
 American Geophysical Union

### **HONORS AND AWARDS**

- 2016 Mentoring Award, University Corporation for Atmospheric Research
- 2016 Scientific and Technical Advancement Award, University Corporation for Atmospheric Research
- 2015 Walter Orr Roberts Technical Achievement Award, High Altitude Observatory, NCAR
- 2012 John W. Firor Outstanding Publication Award, High Altitude Observatory, NCAR
- 2012 NAIRAS Team Group Achievement Award, NASA
- 2011 Solar EUV Experiment Group Achievement Award, NASA
- 2008 TIMED Mission Group Achievement Award, NASA
- 2000 Alumni Society Merit Award, The University of Michigan
- 1995 Editor's Citation for Excellence in Refereeing, Journal of Geophysical Research
- 1991 Outstanding Service Award, American Geophysical Union
- 1988–1989 CEDAR Post-Doctoral Fellow
- 1985 Distinguished Achievement Award, Atmospheric Science, The University of Michigan
- 1975 A.B. cum laude, Harvard College

## RESEARCH GRANTS

- 2018–Present Principal Investigator, Boulder Space Weather Summer School, NSF, Atmospheric and Geospace Sciences Division, Geospace Section
- 2018–Present Co-Investigator, “Daily Atmospheric Ionospheric Limb Imager Cubesat Mission,” NASA, Heliophysics Division, Technology and Instrument Development Program, J. Hecht
- 2016–Present Co-Investigator, “Impact of Carbon Dioxide Trends and the Solar Cycle on Thermosphere-Ionosphere Climate,” NASA, Heliophysics Division, Supporting Research Program, L. Qian
- 2016–Present Co-Investigator, “The Effects of Solar Minimum Irradiance Variability on Whole Atmosphere Climate,” NASA, Heliophysics Division, Living With a Star Program, H.-L. Liu
- 2015–Present Co-Investigator, “Impact of the Neutral Atmosphere on Topside Ionosphere,” NASA, Heliophysics Division, Living With a Star Program, T. J. Fuller-Rowell
- 2014–Present Co-Investigator, “Miniature X-ray Solar Spectrometer Cubesat Mission,” NASA, Heliophysics Division, Technology and Instrument Development Program, T. Woods
- 2014–Present Co-Principal Investigator, “Response of the Atmosphere to Impulsive Solar Events,” NASA, Heliophysics Division, Living With a Star Program, C. Randall
- 2014–2018 Co-Investigator, “Solar Cyclic and Climatic Trends in Geocoronal Hydrogen, NSF, Atmospheric and Geospace Sciences Division, CEDAR Program, S. Nossal
- 2014–2016 Co-Investigator, “Satellite Drag Physical Model for a Near-Real-Time Operations Test Bed,” AFOSR, STTR Program, G. Crowley
- 2013–Present Co-Investigator, “Global Observations of the Limb and Disk,” NASA, Heliophysics Division, Explorer Program, R. Eastes
- 2013–2017 Principal Investigator, “Thermosphere-Ionosphere Impacts of Solar Extreme Ultraviolet Variability,” NASA, Heliophysics Division, Guest Investigator Program
- 2013–2014 Co-Principal Investigator, “Gravity Wave Parameterization in GISS Climate Models,” subcontract from The State University of New York, M. Geller
- 2012–2107 Co-Investigator, CISM Space Weather Summer School, NSF, Atmospheric and Geospace Sciences Division, Aeronomy Program, M. Wiltberger
- 2012–2013 Principal Investigator, “CEDAR Database Transitional Support,” NSF, Aeronomy Program
- 2011–2018 Co-Principal Investigator, “Sun-to-Ice,” NSF, Frontiers in Earth Systems Dynamics Program, H. Spence
- 2011–2013 Co-Investigator, “Global Observations of the Limb and Disk (Phase-A Study),” NASA, Heliophysics Division, Explorer Program, R. Eastes
- 2010–2014 Principal Investigator, “The Upper Atmosphere and Ionosphere at Solar Minimum: Cyclical and Secular Variation,” NASA, Heliophysics Division, Supporting Research and Technology Program
- 2009–2016 Co-Investigator, “Integrated Modeling of the Atmosphere and Ionosphere,” NASA, Heliophysics Division, Living With a Star Program, R. Garcia

2009–2014 Co-Investigator, “Thermospheric Energetics on Solar-cycle, Seasonal, and Storm Time Scales,” NASA, Heliophysics Division, Guest Investigator Program, G. Lu

2008–2011 Principal Investigator, “Ionosphere-Thermosphere Variability: The Interaction of Solar Irradiance Changes with Atmospheric Dynamics,” NASA, Heliophysics Division, Living With a Star Program

2008–2011 Co-Investigator, “Solar Cyclic and Climatic Trends in Geocoronal Hydrogen, NSF, CEDAR Program, S. Nossal

2008–2010 Principal Investigator, “Space Weather Prediction Testbed,” AFWA, Developmental Testbed Center Program

2008–2010 Co-Investigator, “Modeling Density Variation in the Thermosphere,” AFOSR, A. Richmond

2007–2011 Co-Investigator, “Nowcast of Atmospheric Ionizing Radiation for Aviation Safety,” NASA, Earth Sciences Division, Applied Science Program, C. Mertens

2007 Principal Investigator, “Living With a Star Science Workshop,” NASA, Heliophysics Division, Living With a Star Program

2007–2009 Co-Investigator, “Thermospheric/Ionospheric Extension of the Whole Atmosphere Community Climate Model,” ONR, H. Liu

2006–2009 Co-Investigator, “Global Observations of the Limb and Disk (Phase-A Study),” NASA, Heliophysics Division, Mission of Opportunity, R. Eastes

2006–2009 Co-Investigator, “Whole Atmosphere Modeling of the Thermosphere-Ionosphere Responses to Lower-Atmosphere Dynamics and Variability,” NSF, Atmospheric Sciences Division, CEDAR Program, A. Richmond

2005–2008 Co-Investigator, “A Virtual Solar Terrestrial Observatory,” NSF, Cyberinfrastructure Program, P. Fox

2005–2008 Principal Investigator, “Quantification of the Thermospheric Density Response to Solar Forcing,” NASA, Heliophysics Division, Living With a Star Program

2005–2008 Co-Investigator, “Solar Cycle Studies using the Whole Atmosphere Community Climate Model,” NASA, Heliophysics Division, Living With a Star Program, R. Garcia

2004–2007 Co-Investigator, “A Complement of Optical Instruments for the Polar Cap Observatory,” NSF, CEDAR Program, Q. Wu

2003–2006 Principal Investigator, “Global Modeling of Thermospheric Nitric Oxide,” NASA, Sun-Earth Connection, Supporting Research and Technology Program

2002–2013 Co-Director, “Center for Integrated Space Weather Modeling,” NSF, Science and Technology Centers Program, W. J. Hughes

2002–2003 Principal Investigator, “Solar Ultraviolet Energy Deposition for General Circulation Models,” NCAR, Opportunity Fund Program

2001–2004 Principal Investigator, “Measurements of Upper Atmosphere Winds and Temperatures,” NCAR, Strategic Initiative Program

2000–2003 Principal Investigator, “Thermospheric Odd-Nitrogen Response to Aurora,” NASA, Sun-Earth Connection, Supporting Research and Technology Program

2000–2005 Co-Investigator, “Jovian Magnetosphere Explorer (study phase),” NASA, Small Explorer Program, N. Schneider



2000–2001 Co-Investigator, “Ocean Winds and Land Surface Student Satellite (study phase),” NASA, UnESS Program, W. Emery

1997–2002 Co-Investigator, “Program of Excellence Award to ASEN and LASP,” Colorado Commission for Higher Education, A. Seebass

1997–2000 Principal Investigator, “Lower Ionosphere Thermosphere Explorer Concept Study,” NASA, Sun-Earth Connection, New Missions Concepts Program

1996–1997 Principal Investigator, “Thermospheric Airglow Model Validation,” NASA, Space Physics Division, Supporting Research and Technology Program

1994–2000 Deputy Principal Investigator, “The Student Nitric Oxide Explorer,” USRA/NASA, Student Explorer Demonstration Initiative, C. Barth

1994–1997 Co-Investigator, “Solar Irradiance and Thermospheric Airglow Rocket Experiments,” NASA, Space Physics Division, Sub-orbital Program, T. Woods

1994–1997 Co-Investigator, “Confirmatory Analysis of SAGE-I and -II Data,” DOE, Atmospheric Chemistry Program, D. Rusch

1993–2007 Principal Investigator, “Energy Transfer in the Thermosphere and Mesosphere,” NASA, Sun-Earth Connection, TIMED Mission Interdisciplinary Scientist

1993–2010 Co-Investigator, “Solar Extreme-Ultraviolet Experiment,” NASA, Sun-Earth Connection, TIMED Mission, T. Woods

1993–1997 Principal Investigator, “Auroral Emissions Modeling (continuation),” NSF, Atmospheric Sciences Division, CEDAR Program

1993–1996 Co-Investigator, “3D Modeling of Gravity Waves and Airglow,” NSF, Atmospheric Sciences Division, CEDAR Program, J. Isler

1993–1994 Principal Investigator, “Algorithm Development and Testing,” NRL, Space Science Division, E. O. Hulburt Center for Space Research

1992–1995 Principal Investigator, “Thermospheric Airglow Model Enhancement,” NASA, Space Physics Division, Supporting Research and Technology Program

1991–1994 Co-Investigator, “Solar Ultraviolet Irradiance Variation during Solar Cycle 22,” NASA, Space Physics Division, Guest Investigator Program, T. Woods

1991–1994 Co-Investigator, “Solar Extreme Ultraviolet Irradiance Comparison Experiment,” NASA, Space Physics Division, Sub-orbital Program, T. Woods

1990–1993 Co-Investigator, “Aeronomical Spectroscopy in the Ultraviolet at Søndre Strømfjord, Greenland,” NSF, CEDAR Program, R. Niciejewski

1990–1992 Principal Investigator, “Auroral Emissions Modeling,” NSF, Atmospheric Sciences Division, CEDAR Program

1990–1992 Principal Investigator, “Thermospheric Airglow Model Development,” NASA, Space Physics Division, Supporting Research and Technology Program

## PUBLICATIONS

### 1. Thesis

Title: *Tomographic Inversion of Auroral Emissions*  
Date: April 1987  
Institution: The University of Michigan  
Department: Atmospheric and Oceanic Sciences  
Advisors: Paul B. Hays and Vincent J. Abreu

### 2. Publications in Refereed Journals

- 2.1. Abreu, V. J., S. C. Solomon, W. E. Sharp, and P. B. Hays, The dissociative recombination of  $O_2^+$ : The quantum yield of  $O(^1S)$  and  $O(^1D)$ , *J. Geophys. Res.*, **88**, 4140, doi:10.1029/JA088iA05p04140, 1983.
- 2.2. Solomon, S. C., P. B. Hays, and V. J. Abreu, Tomographic inversion of satellite photometry, *Appl. Opt.*, **23**, 3409, doi:10.1364/AO.23.003409, 1984.
- 2.3. Abreu, V. J., A. Dalgarno, J.-H. Yee, S. Chakrabarti, and S. C. Solomon, The OI 989Å tropical nightglow, *Geophys. Res. Lett.*, **11**, 569, doi: 10.1029/GL011i006p00569, 1984.
- 2.4. Solomon, S. C., P. B. Hays, and V. J. Abreu, Tomographic inversion of satellite photometry, *Appl. Opt.*, **24**, 4134, doi:10.1364/AO.24.004134, 1985.
- 2.5. Abreu, V. J., R. W. Eastes, J.-H. Yee, S. C. Solomon, and S. Chakrabarti, Ultraviolet nightglow production near the Earth's equator by neutral particle precipitation, *J. Geophys. Res.*, **91**, 11365, doi:10.1029/JA091iA10p11365, 1986.
- 2.6. Abreu, V. J., J.-H. Yee, S. C. Solomon, and A. Dalgarno, The quenching rate of  $O(^1D)$  by  $O(^3P)$ , *Planet. Space Sci.*, **34**, 1143, doi:10.1016/0032-0633(86)90026-7, 1986.
- 2.7. Hays, P. B., V. J. Abreu, S. C. Solomon, and J.-H. Yee, The visible airglow experiment: A review, *Planet. Space Sci.*, **36**, 21, doi:10.1016/0032-0633(88)90143-2, 1988.
- 2.8. Solomon, S. C., P. B. Hays, and V. J. Abreu, The auroral 6300Å emission: Observations and modeling, *J. Geophys. Res.*, **93**, 9867, doi:10.1029/JA093iA09p09867, 1988.
- 2.9. Solomon, S. C., and V. J. Abreu, The 630 nm dayglow, *J. Geophys. Res.*, **94**, 6817, doi:10.1029/JA094iA06p06817, 1989.
- 2.10. Solomon, S. C., Auroral excitation of the  $N_2$  2P(0,0) and VK(0,9) bands, *J. Geophys. Res.*, **94**, 17215, doi:10.1029/JA094iA12p17215, 1989.
- 2.11. Solomon, S. C., Optical aeronomy, *Rev. Geophys.*, **29**, 1089, 1991.
- 2.12. Buonsanto, M. J., S. C. Solomon, and W. K. Tobiska, Comparison of measured and modeled solar EUV flux and its effect on the  $E-F_1$  region ionosphere, *J. Geophys. Res.*, **97**, 10513, doi:10.1029/92JA00792, 1992.
- 2.13. Schmidtke, G., T. N. Woods, H. Doll, J. Worden, S. C. Solomon, C. Wita, and G. J. Rottman, Solar EUV irradiance from the San Marco ASSI: A reference spectrum, *Geophys. Res. Lett.*, **19**, 2175, doi:10.1029/92GL02183, 1992.
- 2.14. Solomon, S. C., Auroral electron transport using the Monte Carlo method, *Geophys. Res. Lett.*, **20**, 185, doi:10.1029/93GL00081, 1993.
- 2.15. Alexander, M. J., A. I. F. Stewart, S. C. Solomon, and S. W. Bougher, Local-time asymmetries in the Venus thermosphere, *J. Geophys. Res.*, **98**, 10849, doi:10.1029/93JE00538, 1993.

- 2.16. Chang, T., D. G. Torr, P. G. Richards, and S. C. Solomon, Re-evaluation of the  $O^+(^2P)$  reaction rate coefficients derived from Atmosphere Explorer–C observations, *J. Geophys. Res.*, *98*, 15589, doi:10.1029/93JA00957, 1993.
- 2.17. Woods, T. N., G. J. Rottman, S. Bailey, and S. C. Solomon, Vacuum-ultraviolet instruments for solar irradiance and thermospheric airglow, *Opt. Eng.*, *33*, 438, doi:10.1117/12.155911, 1994.
- 2.18. Lancaster, R. S., R. B. Kerr, K. Ng, J. Noto, M. Franco, and S. C. Solomon, Recent observations of the OI 8446 Å emission over Millstone Hill, *Geophys. Res. Lett.*, *21*, 829, doi:10.1029/94GL00705, 1994.
- 2.19. Buonsanto, M. J., P. G. Richards, W. K. Tobiska, S. C. Solomon, Y.-K. Tung, and J. A. Fennelly, Ionospheric electron densities calculated using different EUV flux models and cross sections: Comparison with radar data, *J. Geophys. Res.*, *100*, 14569, doi:10.1029/95JA0068, 1995.
- 2.20. Worden, J., T. N. Woods, G. Rottman, G. Schmidtke, H. Tai, H. Doll, and S. C. Solomon, Calibration of the San Marco airglow-solar spectrometer instrument in the extreme-ultraviolet, *Opt. Eng.*, *35*, 554, doi:10.1117/1.601037, 1996.
- 2.21. Niciejewski, R. J., T. L. Killeen, and S. C. Solomon, Observations of thermospheric horizontal neutral winds at Watson Lake, Yukon Territory, *J. Geophys. Res.*, *101*, 241, doi:10.1029/95JA02683, 1996.
- 2.22. Woods, T. N., G. J. Rottman, S. M. Bailey, S. C. Solomon, and J. R. Worden, Solar extreme ultraviolet irradiance measurements during solar cycle 22, *Solar Phys.*, *177*, 133, doi:10.1117/12.330255, 1998.
- 2.23. Swenson, G. R., R. L. Rairden, S. C. Solomon, and S. Ananth, Imaging spectroscopy for 2-D characterization of auroral emissions, *Appl. Opt.*, *37*, 5760, doi:10.1364/AO.37.005760, 1998.
- 2.24. Rusch, D. W., C. E. Randall, M. T. Callan, M. Horanyi, R. T. Clancy, S. C. Solomon, S. J. Oltmans, B. J. Johnson, U. Koehler, H. Claude, and D. DeMuer, A new inversion for SAGE II data, *J. Geophys. Res.*, *103*, 8465, doi:10.1029/97JD03625, 1998.
- 2.25. Bailey, S. M., T. N. Woods, L. R. Canfield, R. Korde, S. C. Solomon, and G. J. Rottman, Sounding rocket measurements of the solar soft X-ray irradiance, *Solar Phys.*, *186*, 243, doi:10.1023/A:1005141503558, 1999.
- 2.26. Barth, C. A., S. M. Bailey, and S. C. Solomon, Solar-terrestrial coupling: Solar soft X-rays and thermospheric nitric oxide, *Geophys. Res. Lett.*, *26*, 1251, doi:10.1029/1999GL900237, 1999.
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- 3.8. Eastes, R. W., W. McClintock, M. V. Codrescu, A. Aksnes, D. N. Anderson, L. Andersson, D. N. Baker, A. G. Burns, S. A. Budzien, R. E. Daniell, K. F. Dymond, F. G. Eparvier, J. E. Harvey, T. J. Immel, A. Krywonos, M. R. Lankton, J. D. Lumpe, G. W. Prölss, A. D. Richmond, D. W. Rusch, O. H. Siegmund, S. C. Solomon, D. J. Strickland and T. N. Woods, Global-scale observations of the limb and disk (GOLD):



- New observing capabilities for the ionosphere-thermosphere, *Midlatitude Ionospheric Dynamics and Disturbances*, P. M. Kintner, A. J. Coster, T. J. Fuller-Rowell, A. J. Mannucci, M. Mendillo, and R. Heelis, eds., *AGU Geophysical Monograph Series*, 181, 319, 2008.
- 3.9. Fuller-Rowell, T. J., and S. C. Solomon, Flares, coronal mass ejections, and atmospheric responses, in *Heliophysics, Vol. II, Space Storms and Radiation: Causes and Effects*, C. J. Schrijver and G. L. Siscoe, eds., Cambridge University Press, Cambridge, UK, 321, 2010, doi:10.1017/CBO9781139194532.013.
  - 3.10. Solomon, S. C., Terrestrial Ionospheres, *Heliophysics, Vol. III, Evolving Solar Activity and the Climates of Space and Earth*, C. J. Schrijver and G. L. Siscoe, eds., Cambridge University Press, Cambridge, UK, 351, 2010.
  - 3.11. Burns, A. G., W. Wang, S. C. Solomon, and L. Qian, Energetics and composition in the thermosphere, *Modeling the Ionosphere-Thermosphere System*, J. Huba, R. Schunk, and G. Khazanov, eds., *AGU Geophysical Monograph Series*, 201, 39, doi:10.1002/9781118704417.ch4, 2014.
  - 3.12. Qian, L., A. G. Burns, B. A. Emery, B. Foster, G. Lu, A. Maute, A. D. Richmond, R. G. Roble, S. C. Solomon, and W. Wang, The NCAR TIE-GCM: A community model of the coupled thermosphere/ionosphere system, *Modeling the Ionosphere-Thermosphere System*, J. Huba, R. Schunk, and G. Khazanov, eds., *AGU Geophysical Monograph Series*, 201, 73, doi:10.1002/9781118704417.ch7, 2014.

#### 4. Non-Refereed Publications

- 4.1. Woods, T. N., S. M. Bailey, S. C. Solomon, and G. J. Rottman, Far ultraviolet and extreme ultraviolet instrumentation for measuring the solar spectral irradiance and terrestrial airglow, *Instrumentation for Planetary and Terrestrial Atmospheric Remote Sensing*, S. Chakrabarti and A. B. Christensen, eds., *Proceedings of the SPIE*, 1745, 140, 1992.
- 4.2. Rusch, D. W., C. A. Barth, R. T. Clancy, S. C. Solomon, G. M. Lawrence, W. E. McClintock, C. E. Randall, G. E. Thomas, R. R. Garcia, and R. G. Roble, Temperature, Ozone, and Nitric Oxide Experiment (TONE) for the TIMED mission, *Proceedings of the SPIE*, 2266, 424, 1994.
- 4.3. Woods, T. N., G. J. Rottman, R. G. Roble, O. R. White, S. C. Solomon, G. M. Lawrence, J. Lean, and W. K. Tobiska, The TIMED solar EUV experiment, *Proceedings of the SPIE*, 2266, 467, 1994.
- 4.4. Solomon, S. C., S. M. Bailey, T. E. Holden, D. C. O'Connor, J. P. Perich, M. A. Salada, G. Stafford, K. Taylor, J. E. Vian, and P. R. Withnell, The Student Nitric Oxide Explorer, *Proceedings of the 9<sup>th</sup> Annual AIAA/USU Conference on Small Satellites*, Utah State University, 1995.
- 4.5. Solomon, S. C., S. M. Bailey, T. E. Holden, D. C. O'Connor, J. P. Perich, M. A. Salada, G. Stafford, K. Taylor, J. E. Vian, and P. R. Withnell, The Student Nitric Oxide Explorer, *Proceedings of the SPIE*, 2810, 121, doi:10.1117/12.255131, 1996.
- 4.6. Bailey, S. M., C. A. Barth, M. J. Erickson, R. A. Kohnert, A. W. Merkel, E. M. Rodgers, S. C. Solomon, S. D. Straight, and J. E. Vian, Science instrumentation for the Student Nitric Oxide Explorer, *Proceedings of the SPIE*, 2830, 264, 1996.
- 4.7. Solomon, S. C., et al., The SNOE Spacecraft: Integration, test, launch, operation, and on-orbit performance, *Proceedings of the 12<sup>th</sup> Annual AIAA/USU Conference on Small Satellites*, SSC98-IV-3, Utah State University, 1998.

- 4.8. Woods, T. N., S. M. Bailey, F. Eparvier, G. Lawrence, J. Lean, W. McClintock, R. G. Roble, G. Rottman, S. C. Solomon, W. K. Tobiska, G. Ucker, and O. R. White, TIMED solar EUV experiment, *Proceedings of the SPIE*, 3442, 180, 1998.
- 4.9. Solomon, S. C., and D. C. Fritts, What is the Aurora?, *Newton*, 19, 3, 92, 1999.
- 4.10. Withnell, P. R., S. C. Solomon, and D. N. Baker, Small scientific spacecraft from the University of Colorado, *Novel Concepts for Smaller, Faster, and Better Space Missions*, International Astronautical Federation, 1999.
- 4.11. Wu, Q., T. L. Killeen, S. C. Solomon, D. McEwen, and W. Guo, All sky camera and Fabry-Perot interferometer observations in the northern polar cap, *Ocean and Polar Res.*, 24, 237, 2003.
- 4.12. Skinner, W. R., R. J. Niciejewski, T. L. Killeen, S. C. Solomon, R. D. Gablehouse, Q. Wu, D. A. Ortland, D. A. Gell, A. R. Marshall, E. Wolfe., M. Cooper, and J. F. Kafkalidis, Operational Performance of the TIMED Doppler Interferometer (TIDI), *Proceedings of the SPIE*, 5157, 47, 2003.
- 4.13. Wu, Q., R. D. Gablehouse, S. C. Solomon, T. L. Killeen, and C.-Y. She, A new NCAR Fabry-Perot interferometer for upper atmospheric research, *Proceedings of the SPIE*, 5660, 218, 2004.
- 4.14. Luhmann, J. G., and S. C. Solomon, The Sun-Earth Connection, *Encyclopedia of the Solar System*, 2<sup>nd</sup> edition, L. McFadden, P. R. Weissman, and T. V. Johnson, eds., pp. 213-226, Academic Press/Elsevier, 2007.
- 4.15. Solomon, S. C., Effects of carbon dioxide on the upper atmosphere, *McGraw-Hill Yearbook of Science and Technology*, 107, 2008.
- 4.16. Solomon, S. C., and R. G. Roble, Thermosphere, *McGraw-Hill Encyclopedia of Science and Technology*, 2012.
- 4.17. Luhmann, J. G., and S. C. Solomon, Space weather, *Encyclopedia of the Solar System*, 3<sup>rd</sup> edition, T. Spohn, D. Breuer, and T. V. Johnson, eds., ch. 22, Academic Press/Elsevier, 2014.
- 4.18. Solomon, S. C., and R. G. Roble, Thermosphere, *Encyclopedia of Atmospheric Sciences*, 2<sup>nd</sup> edition, Vol. 5, pp. 402-408, 2014.

## 5. Selected Conference Presentations

Over 500 presentations at conferences, symposia, and workshops, including the following invited presentations:

- 5.1. “Airglow and Auroral Emissions Modeling,” S. C. Solomon, CEDAR Summer Workshop, Boulder, Colorado, 1989 (invited).
- 5.2. “Dynamical Effects on Polar Thermosphere Composition and Auroral Spectra,” S. C. Solomon and R. G. Roble, American Geophysical Union Fall Meeting, San Francisco, California, 1989 (invited).
- 5.3. “Effects of Solar Radiation on the Thermosphere and Ionosphere,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 1990 (invited).
- 5.4. “Global Modeling of the Twilight Airglow,” S. C. Solomon, R. G. Roble, and V. J. Abreu, American Geophysical Union Spring Meeting, Baltimore, Maryland, 1991 (invited).
- 5.5. “Airglow Emissions and Photochemical Processes,” S. C. Solomon, Chapman Conference on the Mesosphere and Lower Thermosphere, Asilomar, California, 1992 (invited).

- 5.6. “Numerical Models of Auroral Particle Transport,” S. C. Solomon, 7th Scientific Assembly of the International Association of Geomagnetism and Aeronomy, Buenos Aires, Argentina 1993 (invited).
- 5.7. “Educational Aspects of the Student Explorer Demonstration Initiative,” S. C. Solomon, C. A. Barth, D. Cotton, and S. Chakrabarti, American Geophysical Union Spring Meeting, Baltimore, Maryland, 1995 (invited).
- 5.8. “The STEDI Program — The Reality of Low Cost Access to Space,” S. C. Solomon and D. Cotton, GSFC Small Spacecraft Workshop, Greenbelt, Maryland 1995 (invited).
- 5.9. “The Student Nitric Oxide Explorer,” S. C. Solomon and C. A. Barth, American Geophysical Union Front Range Meeting, Boulder, Colorado, 1996 (invited).
- 5.10. “The Student Nitric Oxide Explorer,” S. C. Solomon, GSFC Small Spacecraft Missions Symposium, Greenbelt, Maryland, 1996 (invited).
- 5.11. “Lower Ionosphere Thermosphere Explorer,” S. C. Solomon, S. M. Bailey, G. M. Lawrence, and W. E. McClintock, Space Physics Roadmap Meeting, Pasadena, California, 1996 (invited).
- 5.12. “The Student Nitric Oxide Explorer,” S. C. Solomon and C. A. Barth, Universities Space Research Association Annual Meeting, Washington, District of Columbia, 1998 (invited).
- 5.13. “Thermosphere/Ionosphere and Airglow Modeling,” S. C. Solomon, TIGER Meeting, Freiburg, Germany, 1998 (invited).
- 5.14. “Photochemical Modeling of the Thermosphere and Ionosphere,” S. C. Solomon, TIGER meeting, St. Petersburg, Russia, 1999 (invited).
- 5.15. “Electron Densities in the Mid-latitude  $E$  and  $F_1$  Ionosphere: Measurements, Models, and the Effects of New Solar Soft X-ray Observations,” S. C. Solomon and S. M. Bailey, American Geophysical Union Fall Meeting, San Francisco, California, 2000 (invited).
- 5.16. “Solar extreme-ultraviolet and X-ray variability: Effects on the thermosphere and ionosphere,” S. C. Solomon, TIGER Meeting, Boulder, Colorado, 2001 (invited).
- 5.17. “Thermosphere-ionosphere modeling using solar ultraviolet and X-ray measurements from TIMED and SNOE,” S. C. Solomon, S. M. Bailey, F. G. Eparvier, G. R. Gladstone, L. J. Paxton, and T. N. Woods, Western Pacific Geophysics Meeting, Wellington, New Zealand, 2002 (invited).
- 5.18. “New measurements by the TIMED Solar Extreme-Ultraviolet Experiment: Implications for Thermospheric Modeling,” S. C. Solomon, S. M. Bailey, F. G. Eparvier, G. R. Gladstone, L. J. Paxton, and T. N. Woods, European Geophysical Society Spring Meeting, Nice, France, 2003 (invited).
- 5.19. “Solar ultraviolet and X-ray energy deposition in the thermosphere,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2003 (invited).
- 5.20. “Thermosphere/ionosphere response to large solar flares,” S. C. Solomon, L. Qian, A. D. Richmond, R. G. Roble, and T. N. Woods, Living with a Star Workshop, Boulder, Colorado, 2004 (invited).
- 5.21. “Coupled Solar-Terrestrial Simulations by the Center for Integrated Space Weather Modeling,” S. C. Solomon and the CISM Team, Challenges to Modeling the Sun-Earth System workshop, Huntsville, Alabama, 2004 (invited).
- 5.22. “Simulations of Ionospheric Storms using a Coupled Magnetosphere-Ionosphere-Thermosphere Model,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2005 (invited).

- 5.23. “Application of Measured Parameters to Large-Scale Numerical Modeling of Solar-Terrestrial Systems: An Overview,” S. C. Solomon and G. Siscoe, American Meteorological Society Annual Meeting, Atlanta, Georgia, 2006 (invited).
- 5.24. “Modeling Thermospheric Neutral Density — Past, Present, and Future,” S. C. Solomon, L. Qian, and R. G. Roble, Neutral Density Workshop, Colorado Springs, Colorado, 2006 (invited).
- 5.25. “Upper Atmosphere Response to Solar Irradiance Variation — A Review of Progress in the International TIGER Program,” S. C. Solomon, 36<sup>th</sup> COSPAR Scientific Assembly, Beijing, China, 2006 (invited).
- 5.26. “Observations and Modeling of Space Weather Impacts on the Earth,” S. C. Solomon, American Physical Society Four Corners Meeting, Logan, Utah, 2006 (invited).
- 5.27. “Preliminary Evaluation of GNSS Occultation Measurements of the Ionosphere by COSMIC,” S. C. Solomon, A. G. Burns, J. Lei, and Z. Zeng, COSMIC Retreat, Boulder, Colorado, 2006 (invited).
- 5.28. “Community Modeling in the Atmospheric Sciences,” S. C. Solomon, SHINE Meeting, Whistler, British Columbia, Canada, 2007.
- 5.29. “Ultraviolet and X-ray solar Irradiance: Consequences for the Terrestrial Upper Atmosphere,” S. C. Solomon, L. Qian, and R. G. Roble, Living With a Star Workshop, Boulder, Colorado, 2007 (invited).
- 5.30. “Modeling the Atmosphere/Ionosphere: The Known Unknowns,” S. C. Solomon, Space-Based Ionosphere-Thermosphere Research Meeting, Manhattan Beach, California, 2007 (invited).
- 5.31. “Measurements and Models of the Ionosphere: Results from the Formosat-3/COSMIC Mission,” S. C. Solomon, A. G. Burns, J. Lei, X. Luan, W. Wang, and Z. Zeng, 4<sup>th</sup> Asian Space Conference, Taipei, Taiwan, 2008 (invited).
- 5.32. “The Thermosphere at Solar Minimum,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2008 (invited).
- 5.33. “Measurements and Models of the Ionosphere: Science Requirements for Space Weather,” S. C. Solomon, A. G. Burns, J. Lei, C. Lin, X. Luan, P. Straus, W. Wang, and Z. Zeng, GNSS Radio Occultation Workshop, Pasadena, California, 2009 (invited).
- 5.34. “Particle Precipitation in the Thermosphere/Ionosphere,” S. C. Solomon, HEPPA Workshop, Boulder, Colorado, 2009 (invited).
- 5.35. “Whi is the Thermosphere Cold?,” S. C. Solomon and L. Qian, Whole Heliosphere Interval Workshop, Boulder, Colorado, 2009 (invited).
- 5.36. “The Upper Atmosphere and Ionosphere at Solar Minimum: Cyclical and Secular Variation,” S. C. Solomon and L. Qian, American Geophysical Union Fall Meeting, San Francisco, California, 2009 (invited).
- 5.37. “Solar Forcing of the Thermosphere-Ionosphere System from Maximum to Minimum,” S. C. Solomon, L. Qian, and T. N. Woods, American Geophysical Union Fall Meeting, San Francisco, California, 2009 (invited).
- 5.38. “TIE-GCM at CCMC,” S. C. Solomon, B. Foster, A. D. Richmond, R. G. Roble, A. Maute, A. G. Burns, W. Wang, L. Qian, and P. Schmitt, CCMC Workshop, Key Largo, Florida, 2010 (invited).
- 5.39. “Search for a Thermospheric Ground State Suspended due to Cold and Dark,” S. C. Solomon, Meeting of the Americas, Iguazu, Brazil, 2010 (invited).

- 5.40. “Modeling Upper Atmosphere Trends,” S. C. Solomon, R. G. Roble, and L. Qian, Coupling Between The Earth's Atmosphere And Its Plasma Environment Workshop, International Space Science Institute, Bern, Switzerland, 2010 (invited).
- 5.41. “Is There Enough Extreme Ultraviolet Radiation to Maintain the Global Mean Thermospheric Temperature? Revisiting a 37-year-old Problem,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2010 (invited).
- 5.42. “Solar, Geomagnetic, and Chemical Effects on the Climate of the Upper Atmosphere,” S. C. Solomon, Space Climate Symposium 4, Goa, India, 2011 (invited).
- 5.43. “Causes of Low Thermospheric Density During the 2007-2009 Solar Minimum,” S. C. Solomon and L. Qian, European Geosciences Union General Assembly, Vienna, Austria, 2011 (invited).
- 5.44. “The Future of Space Weather Modeling,” S. C. Solomon, CEDAR Summer Workshop, Santa Fe, New Mexico, 2011 (invited).
- 5.45. “Thermosphere-Ionosphere Response to Structures in the Solar Wind and Interplanetary Magnetic Field,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2011 (invited).
- 5.46. “TIE-GCM Updates,” S. C. Solomon, A. G. Burns, B. A. Emery, B. Foster, A. Maute, L. Qian, A. D. Richmond, R. G. Roble, and W. Wang, CCMC Workshop, Key Largo, Florida, 2012 (invited).
- 5.47. “Thermospheric Temperature Trends: Modeling and Observations,” S. C. Solomon, Polar Mesospheric Cloud Trends Workshop, Boulder, Colorado, 2012 (invited).
- 5.48. “An Introduction to Terrestrial Ionospheres,” S. C. Solomon, Comparative Climatology of Terrestrial Planets Meeting, Boulder, Colorado, 2012 (invited).
- 5.49. “The Solar Minimum Between Cycles 23 and 24,” S. C. Solomon, Solar Dynamics Observatory Extreme-Ultraviolet Variability Experiment Workshop, Yosemite, California, 2012 (invited).
- 5.50. “Ionosphere-Thermosphere Disturbances During Solar Minimum,” S. C. Solomon, M. Wiltberger, and L. Qian, Earth-Sun System Exploration Conference, Kona, Hawaii, 2013 (invited).
- 5.51. “The Effect of Co-Rotating Interaction Regions on the Thermosphere and Ionosphere,” S. C. Solomon, M. Wiltberger, and L. Qian, Asia Oceania Geophysical Society Annual Meeting, Brisbane, Australia, 2013 (invited).
- 5.52. “Upper Atmosphere Observations from the International Space Station,” S. C. Solomon, International Space Station Research and Development Conference, Denver, Colorado, 2013 (invited).
- 5.53. “Solar Variability and the Upper Atmosphere,” S. C. Solomon, Living With a Star 10<sup>th</sup> Anniversary Workshop, Princeton, New Jersey, 2013 (invited).
- 5.54. “Evolution of the Thermosphere Under a Quiet Sun,” S. C. Solomon and L. Qian, Climate and Weather of the Sun-Earth System Symposium, Nagoya, Japan, 2013 (invited).
- 5.55. “Forecasting Space Weather in the Upper Atmosphere and Ionosphere,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2013 (invited).
- 5.56. “TIE-GCM v. 2.0,” S. C. Solomon, A. G. Burns, B. A. Emery, B. Foster, A. Maute, L. Qian, A. D. Richmond, R. G. Roble, and W. Wang, Community Coordinated Modeling Center Workshop, Annapolis, Maryland, 2014 (invited).

- 5.57. “Feasibility of Short-Term Forecasting for the Thermosphere-Ionosphere,” S. C. Solomon, JPL Technical Interchange Meeting, Pasadena, California, 2014 (invited).
- 5.58. “Solar EUV Input to Ionosphere/Thermosphere Models,” S. C. Solomon, GOES VW Workshop, Boulder, Colorado, 2015 (invited).
- 5.59. “Particle Precipitation in the Thermosphere-Ionosphere,” S. C. Solomon, American Geophysical Union Joint Assembly, Montreal, Canada, 2015 (invited).
- 5.60. “Interaction of the Sub-Auroral Boundary Region with the Equatorial Dynamo,” S. C. Solomon, W. Wang, and M. Wiltberger, URSI Atlantic Radio Science Conference, Gran Canaria, Spain, 2015 (invited).
- 5.61. “Thermospheric Climate Change,” S. C. Solomon and L. Qian, CEDAR Summer Workshop, Seattle, Washington, 2015 (invited).
- 5.62. “TIE-GCM and WACCM-X,” S. C. Solomon, A. G. Burns, B. A. Emery, B. Foster, A. Maute, L. Qian, A. D. Richmond, R. G. Roble, and W. Wang, Community Coordinated Modeling Center Workshop, Annapolis, Maryland, 2016 (invited).
- 5.63. “Thermosphere-Ionosphere Response to Anthropogenic Climate Change Modeled by WACCM-X,” S. C. Solomon, H.-L. Liu, D. R. Marsh, J. McInerney, L. Qian, and F. Vitt, TREND-2016 Workshop, Kuhlungsborn, Germany, 2016 (invited).
- 5.64. “Solar Soft X-rays and the Ionosphere *E*-region Problem,” S. C. Solomon, L. Qian, and T. N. Woods, American Geophysical Union Fall Meeting, San Francisco, California, 2016 (invited).
- 5.65. “Climate Change in the Upper Atmosphere,” S. C. Solomon, H.-L. Liu, D. N. Marsh, J. McInerney, L. Qian, and F. Vitt, American Geophysical Union Fall Meeting, San Francisco, California, 2016 (invited).
- 5.66. “New Opportunities in Geospace Remote Sensing,” S. C. Solomon, American Geophysical Union Fall Meeting, New Orleans, Louisiana, 2017 (invited).
- 5.67. “Space Weather Studies by new NASA Missions Collaborating with the Formosat 7 / COSMIC 2 Satellite Program,” S. C. Solomon, International Conference on GPS Radio Occultation, Taipei, Taiwan, 2018 (invited).
- 5.68. “Whole Atmosphere Simulation of Anthropogenic Climate Change,” S. C. Solomon, H.-L. Liu, D. R. Marsh, J. McInerney, L. Qian, and F. Vitt, TREND-2018 Workshop, Hefei, China, 2018 (invited).
- 5.69. “Atmospheric Modeling using Solar Irradiance Estimates,” S. C. Solomon, Triennial Earth-Sun Summit, Leesburg, Virginia, 2018 (invited).
- 5.70. “Simulation of Climate Change from the Surface to the Exobase,” Solomon, S. C., H.-L. Liu, D. R. Marsh, J. M. McInerney, and L. Qian, CEDAR Workshop, Santa Fe, New Mexico, 2018 (invited).
- 5.71. “Whole Atmosphere Modeling of Ionospheric Space Weather,” S. C. Solomon, Systems Science Workshop, Los Alamos, New Mexico, 2018 (invited).
- 5.72. “Observations of the Thermosphere and Ionosphere by the NASA GOLD Mission,” S. C. Solomon, A. G. Burns, R. W. Eastes, and W. E. McClintock, Japan Geophysical Union Annual Meeting, Tokyo, Japan, 2019 (invited).
- 5.73. “Whole Atmosphere Climate Change,” S. C. Solomon, H.-L. Liu, D. R. Marsh, J. M. McInerney, and L. Qian, CEDAR Workshop, Santa Fe, New Mexico, 2019 (invited).
- 5.74. “Terrestrial Ionospheres from Marconi to MAVEN,” S. C. Solomon, American Geophysical Union Fall Meeting, San Francisco, California, 2019 (invited).