

CURRICULUM VITAE

WILLIAM J. RANDEL

Personal Data:

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Education:

Iowa State University	PhD Physics (1984)
University of Cincinnati	BS Physics (1978)

Professional Experience:

National Center for Atmospheric Research	
Section Head for Remote Sensing, ACOM	3/15 - present
Director, Atmospheric Chemistry Division	4/07 – 2/15
Senior Scientist	7/00 - present
Scientist III	7/95 - 6/00
Head, Satellite Data Analysis Group, ACD	11/94 - 4/07
Scientist II	2/92 - 6/95
Visiting Scientist/Scientist I	9/87 - 1/92
Advanced Study Program Postdoctoral Fellow	9/85 - 8/87
Cooperative Research Center for Southern Hemisphere Meteorology, Monash University, Melbourne, Australia	
Visiting Scientist (on sabbatical leave)	9/95 - 7/96
Colorado State University	
Postdoctoral Research Associate	9/84 - 8/85

Honors and Awards:

Fellow of the American Geophysical Union, 2015

Fellow of the American Meteorological Society, 2009

Elected to the International Ozone Commission, 2008

Part of the Intergovernmental Panel on Climate Change (IPCC) Scientific Team awarded the Nobel Peace Prize in 2007

Editor's Award for Excellence in Reviewing, *Geophysical Research Letters*, 1999, 2006, 2008

NASA Group Achievement Award for Upper Atmosphere Research Satellite (UARS) Team, 2006

NASA Group Achievement Award for Contributions to the AURA Project, 2005.

WMO Norbert Gerbier Outstanding Publication Award, 2002 (co-author of *Rev. Geophysics* paper in 2001)

Advanced Study Program Postdoctoral Fellowship, NCAR (1985-1987)

Outstanding Teaching Award from Department of Physics, Iowa State University, 1980

Sigma Pi Sigma, Physics National Honor Society

Professional Service and Activities:

Houghton Lecturer, Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology. May-June 2015.

Principal Lecturer, Workshop on Fluid Dynamics in Earth and Planetary Sciences, Kyoto, Japan. December 2014.

Contributing author for Working Group I to the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change.

Principal Investigator, International Space Station Atmospheric Trace Molecule Occultation Spectrometer (iATMOS). Proposal to the NASA Earth Venture 2 (EV2) Earth System Science Pathfinder (ESSP) program. Submitted September 2011 (declined).

Lead Author for 2002, 2006 and 2010 UNEP/WMO Scientific Assessments of Ozone Depletion Scientific Steering Committee, Network for the Detection of Atmospheric Composition Change (NDACC), 2004-2014

Scientific Steering Group for Stratospheric Temperature Trends activity, Stratosphere-troposphere Processes and their Role in Climate (SPARC), World Climate Research Program (WCRP), 1996-present. Co-chair 2005-2015.

International Ozone Commission, 2009-present.

Chair, National Research Council review committee for the US Climate Change Science Program (CCSP) Synthesis and Assessment Report on Temperature Trends in the Lower Atmosphere, 2005.

Lead author, Intergovernmental Panel on Climate Change (IPCC) Special Report on Safeguarding the Ozone Layer and the Global Climate System, 2005. (Chapter 1: Ozone and Climate: A Review of Interconnections).

Associate Editor, Journal of the Atmospheric Sciences, 1999-present.

National Research Council Board on Atmospheric Science and Climate (BASC), 2001-2005.

Scientific Advisory Panel for Integrated Global Atmospheric Chemistry Observations (IGACO) – Ozone. 2006.

Member, Working Group on Observation and Assimilation (WOAP), World Climate Research Program (WCRP) Project on Coordinated Observation and Prediction of the Earth System (COPES). 2004-2007.

Chair, SPARC Stratospheric Reference Climatology Group. 1994 - 2003.

Chair, SPARC- International Ozone Commission (IOC) Committee on Ozone Trends, 1996-1998; Lead author for 'Assessment of Trends in the Vertical Profile of Ozone', SPARC Report No. 1, 1998.

NASA Science Teams for the Upper Atmosphere Research Satellite (UARS), Stratospheric Aerosol and Gas Experiment (SAGE II), High Resolution Dynamics Limb Sounder (HIRDLS), Atmospheric Infrared Spectrometer (AIRS), GPS radio occultation and Aura Science Team. 1994-present.

Chair, Committee on Atmospheric Dynamics, American Geophysical Union (AGU) Atmospheric Sciences Section, 1996 - 2002.

Principal Organizer of US-Japanese Workshop on Coupling of the Troposphere and Stratosphere, Kyoto, March 2001.

Chair, American Meteorological Society Committee on the Middle Atmosphere, 1995-1997.

American Meteorological Society Committee on Southern Hemisphere Meteorology and Oceanography, 1990-1993.

Contributing author and Scientific Review Panel for UNEP/WMO Scientific Assessment of Ozone Depletion, 1994, 1998 and 2014.

Editorial Advisory Board, Encyclopedia of Atmospheric Sciences, Published by Academic Press, 1999-2002.

NCAR Activities:

Director of Atmospheric Chemistry Division, 2007-2015. Responsible for budgets, personnel and overall scientific direction for a staff of ~80.

Upper Troposphere/Lower Stratosphere (UTLS) Initiative Scientific Steering Group, 2002-2010.

Project Scientist for START05, START08 and CONTRAST field experiments, 2005-2014.

NCAR Appointments Review Group (ARG) 2001-2003, 2014-2016 (Chair, 2003, 2014)

Organizer for John Gille Symposium at NCAR, November, 2014

Educational activities at NCAR

Postdoctoral advisor for Dr. Mijeong Park (2004-2006), Dr. Jeffrey Taylor (2008-2010), Dr. Joowan Kim (2013-present) and Dr. Marta Abalos (2015-present).

PhD advisor for Beth Stone at NCAR (Iowa State University, PhD 1997), Marta Abalos (Universidad Complutense de Madrid, Madrid, Spain, PhD 2013).

SOARS Scientific Mentor 1993-2003

PhD committees for Rei Ueyama (U. Washington, PhD 2010), Kevin Grise (Colorado State U., PhD 2010), Katrina Virts (U. Washington, PhD 2013), Nick Davis (Colorado State U., 2013-present).

Research Grants (Funded):

Co-Investigator (PI: John Gille): Studies of Middle Atmospheric Processes using Satellite Data and Models. NASA, 1990-1992, \$402 K.

Co-Investigator (PI: John Gille): Studies of Stratospheric Variability Related to Global Change. NASA, 1993-1996, \$278 K.

Principal Investigator: Validation and Analyses of Operational Stratospheric Ozone Data. NOAA, 1993-1996, \$160 K.

Principal Investigator: Stratospheric Transport and Chemistry Studies using UARS Constituent Data. NASA, 1994-1997, \$166 K.

Principal Investigator: Studies of Stratospheric Interannual Variability in SAGE II data. NASA, 1996-1999, \$241 K.

Principal Investigator: Studies of Interannual Stratospheric Variability Related to Global Change. NASA, 1996-1999, \$298 K.

Principal Investigator: Seasonal and Interannual Stratospheric Variability derived from UARS data. NASA, 1997-2000, \$266 K.

Principal Investigator: Studies of Stratosphere-Troposphere Coupling on Seasonal and Interannual Time Scales. NASA, 1999-2002, \$468 K.

Co-Principal Investigator (with Prof. Shigeo Yoden of Kyoto University): Coupling of the Troposphere and Stratosphere by Dynamical, Radiative and Chemical Processes. (A joint US-Japanese workshop in Kyoto, March, 2001). NSF, 2000-2001, \$25K.

Principal Investigator: Global Variability from 10-80 km studied with UARS data. NASA, 2001-2004, \$421 K.

Co-Principal Investigator (with Andrew Gettelman): Tropical stratosphere-troposphere exchange of water vapor: Advanced models and simulations. NASA, 2001-2004, \$225 K.

Principal Investigator: Dynamical and chemical variability near the global tropopause. NASA, 2002-2005, \$463 K.

Principal Investigator: EOS integrated investigations of upper tropospheric water, clouds and temperature. NASA, 2004-2007, \$738 K.

Principal Investigator: Studies of Stratosphere-Troposphere Coupling Using High Vertical

Resolution Satellite Data. NASA, 2005-2008, \$584 K.

Principal Investigator: Studies of atmospheric dynamics using high vertical resolution GPS data. NASA, 2007-2010, \$554 K.

Principal Investigator: Variability of UTLS water vapor, isotopes and tracers derived from Aura MLS and ACE satellite data. NASA, 2011-2014, \$592 K.

Principal Investigator: Quantifying thermal variability of the UTLS using GPS radio occultation data. NASA, 2012-2015, \$609 K.

Principal Investigator: Diagnosing UTLS chemical variability using Aura MLS, OSIRIS and ACE-FTS measurements. NASA, 2014-2017, \$552 K.

Principal Investigator: Diagnosing tracer transport by the Brewer-Dobson circulation and eddy fluxes using observations and models. NASA, 2015-2017, \$402 K.

Principal Investigator: Diagnosing fine-scale atmospheric variability using GPS radio occultation data. NASA, 2015-2018, \$681K.

Refereed Publications:

Randel, W.J., and J.L. Stanford, 1983: Structure of medium-scale waves in the Southern Hemisphere summer. *J. Atmos. Sci.*, 40, 2312-2318.

Randel, W.J., and J.L. Stanford, 1985: An observational study of medium-scale wave dynamics in the Southern Hemisphere summer. Part I: Wave structure and energetics. *J. Atmos. Sci.*, 42, 1172-1188.

Randel, W.J., and J.L. Stanford, 1985: An observational study of medium-scale wave dynamics in the Southern Hemisphere summer. Part II: Stationary-transient wave interference. *J. Atmos. Sci.*, 42, 1189-1197.

Randel, W.J., and J.L. Stanford, 1985: The observed life cycle of a baroclinic instability. *J. Atmos. Sci.*, 42, 1364-1373.

Boville, B.A., and W.J. Randel, 1986: Observations and simulation of the variability of the troposphere and stratosphere in January. *J. Atmos. Sci.*, 43, 3015-3034.

Randel, W.J., 1987: A study of planetary waves in the southern winter troposphere and stratosphere. Part I: Wave structure and vertical propagation. *J. Atmos. Sci.*, 44, 917-935.

Randel, W.J., D.E. Stevens and J.L. Stanford, 1987: A study of planetary waves in the southern

- winter troposphere and stratosphere. Part II: Life cycles. *J. Atmos. Sci.*, 44, 936-949.
- Randel, W.J., and B.A. Boville, 1987: Observations of a major stratospheric warming during December 1984. *J. Atmos. Sci.*, 44, 2179-2186.
- Randel, W.J., 1987: The evaluation of winds from geopotential height data in the stratosphere. *J. Atmos. Sci.*, 44, 3097-3120.
- Randel, W.J., 1988: The seasonal evolution of planetary waves in the Southern Hemisphere stratosphere and troposphere. *Quart. J. Roy. Meteorol. Soc.*, 114, 1385-1409.
- Randel, W.J., 1988: Further modification of time-longitude lag-correlation diagrams: Application to three dimensional wave propagation. *Tellus*, 40A, 557-571.
- Newman, P.A. and W.J. Randel, 1988: Coherent ozone-dynamical changes in the Southern Hemisphere spring, 1979-1986. *J. Geophys. Res.*, 93, 12,585-12,606.
- Randel, W.J., 1988: The anomalous circulation in the Southern Hemisphere stratosphere during spring 1987. *Geophys. Res. Lett.*, 15, 911-914.
- Randel, W.J., 1990: Coherent wave-zonal mean flow interactions in the troposphere. *J. Atmos. Sci.*, 47, 439-456.
- Randel, W.J., 1990: A comparison of the dynamic life-cycles of tropospheric medium-scale waves and stratospheric planetary waves. *Dynamics, Transport and Photochemistry in the Middle Atmosphere of the Southern Hemisphere*. Dordrecht, Reidel, pp. 91-109.
- Randel, W.J., and D.L. Williamson, 1990: A comparison of the climate simulated by the NCAR Community Climate Model (CCM1:R15) with ECMWF analyses. *J. Climate*, 3, 608-633.
- Randel, W.J., 1990: Kelvin wave induced trace constituent oscillations in the equatorial stratosphere. *J. Geophys. Res.*, 95, 18,641-18,652.
- Randel, W.J., B.A. Boville and J.C. Gille, 1990: Observations of planetary mixed Rossby-gravity waves in the upper stratosphere. *J. Atmos. Sci.*, 47, 3078-3091.
- Randel, W.J., and I.M. Held, 1991: Phase speed spectra of transient eddy fluxes and critical layer absorption. *J. Atmos. Sci.*, 48, 688-697.
- Randel, W.J., and L.R. Lait, 1991: Dynamics of the 4-day wave in the Southern Hemisphere winter stratosphere. *J. Atmos. Sci.*, 48, 2496-2508.
- Randel, W.J., and J.C. Gille, 1991: Kelvin wave variability in the upper stratosphere observed in

- SBUV ozone data. *J. Atmos. Sci.*, 48, 2336-2349.
- Randel, W.J., 1992: Upper tropospheric equatorial waves in ECMWF analyses. *Quart. J. Roy. Meteorol. Soc.*, 118, 365-394.
- Boville, B.A., and W.J. Randel, 1992: Equatorial waves in a stratospheric GCM: Effects of vertical resolution. *J. Atmos. Sci.*, 49, 785-801.
- Randel, W.J., 1993: Global normal mode Rossby waves observed in stratospheric ozone data. *J. Atmos. Sci.*, 50, 406-420.
- Randel, W.J., 1993: Global variations of zonal mean ozone during stratospheric warming events. *J. Atmos. Sci.*, 50, 3308-3321.
- Randel, W.J., 1993: Ideas flow on Antarctic vortex. *Nature*, 364, 105-106.
- Randel, W.J., J.C. Gille, A.E. Roche, J.B. Kumer, J.L. Mergenthaler, J.W. Waters, E.F. Fishbein and W.A. Lahoz, 1993: Stratospheric transport from tropics to middle latitudes by planetary wave mixing. *Nature*, 365, 533-535.
- Manney, G.L., and W.J. Randel, 1993: Instability at the winter stratopause: A mechanism for the 4-day wave. *J. Atmos. Sci.*, 50, 3928-3938.
- Randel, W.J., 1994: Observations of the 2-day wave in NMC stratospheric analyses. *J. Atmos. Sci.*, 51, 306-313.
- Randel, W.J., and R.R. Garcia, 1994: Application of a planetary wavebreaking parameterization to stratospheric circulation statistics. *J. Atmos. Sci.*, 51, 1157-1168.
- Randel, W.J., and J.B. Cobb, 1994: Coherent variations of monthly mean total ozone and lower stratospheric temperature. *J. Geophys. Res.*, 99, 5433-5447.
- Randel, W.J., 1994: Filtering and Data Preprocessing for Time Series Analyses. Chapter 10 for 'Probabilistic and Statistical Methods in the Physical Sciences', Volume 29 in "*Methods in Experimental Physics*", Edited by J. Stanford and S. Vardeman, Academic Press, 542 pp.
- Randel, W.J., B.A. Boville, J.C. Gille, P.L. Bailey, S.T. Massie, J. Kumer, J. Mergenthaler and A. Roche, 1994: Simulation of stratospheric N₂O in the NCAR CCM2: Comparisons with CLAES data and global budget analyses. *J. Atmos. Sci.*, 51, 2834-2845.
- Randel, W.J., and F. Wu, 1995: TOMS total ozone trends in potential vorticity coordinates. *Geophys. Res. Lett.*, 22, 683-686.

- Harris, N.R.P., and coauthors, 1995: Ozone Measurements. Chapter 1 of *The Scientific Assessment of Ozone Depletion: 1994*. World Meteorological Organization Report No. 37.
- Randel, W.J., F. Wu, J.M. Russell III, J. Waters, and L. Froidevaux, 1995: Ozone and temperature changes in the stratosphere following the eruption of Mt. Pinatubo. *J. Geophys. Res.*, 100, 16,753-15,764.
- Randel, W.J., and F. Wu, 1996: Isolation of the ozone QBO in SAGE II data by singular value decomposition. *J. Atmos. Sci.*, 53, 2546-2559.
- Lawrence, B.N., and W.J. Randel, 1996: Variability in the mesosphere observed by the NIMBUS 6 PMR. *J. Geophys. Res.*, 101, 23,475-23,489.
- Ramaswamy, V., M.D. Schwartzkopf, and W.J. Randel, 1996: Fingerprint of ozone depletion in the spatial and temporal pattern of recent lower stratosphere cooling. *Nature*, 382, 616-618
- Stone, E.M., W.J. Randel, J.L. Stanford, W.G. Read and J.W. Waters, 1996: Baroclinic wave variations observed in MLS upper tropospheric water vapor. *Geophys. Res. Lett.*, 23, 2967-2970.
- Massie, S.T., W.J. Randel, et al., 1997: Simultaneous observations of polar stratospheric clouds and HNO₃ over Scandinavia in January 1992. *Geophys. Res. Lett.*, 24, 595-598
- Harris, N.R.P., W.J. Randel, et al., 1997: Trends in stratospheric and free tropospheric ozone. *J. Geophys. Res.*, 102, 1571-1590.
- Tie, X.-X., C. Granier, W.J. Randel and G.P. Brasseur, 1997: Effects of interannual variation of temperature on heterogeneous reactions and stratospheric ozone. *J. Geophys. Res.*, 102, 23,519-23,527.
- Waugh, D.W., T.M. Hall., W.J. Randel, et al., 1997: Three-dimensional simulations of long-lived tracers using winds from MACCM2. *J. Geophys. Res.*, 102, 21,493-21,513.
- Randel, W.J., F. Wu., J.M. Russell III, A. Roche and J. Waters, 1998: Seasonal cycles and QBO variations in stratospheric CH₄ and H₂O observed in UARS HALOE data. *J. Atmos. Sci.*, 55, 163-185.
- Pan, L., S. Solomon, W.J. Randel, et al., 1997: Hemispheric asymmetries and seasonal variations of the lowermost stratosphere water vapor and ozone derived from SAGE II data. *J. Geophys. Res.*, 102, 28,177-28,184.
- Solomon, S., R. Portman, R. Garcia, W.J. Randel, et al., 1998: Ozone depletion at midlatitudes: Coupling of volcanic aerosols and temperature variability to anthropogenic chlorine.

Geophys. Res. Lett., 25, 1871-1874.

Stratospheric Processes and their Role in Climate (SPARC), 1998: Assessment of trends in the vertical distribution of ozone. SPARC Report No. 1, 416 pp. Edited by N. Harris, R. Hudson and C. Philips. (Lead author for Chapter 3: Ozone change as a function of altitude).

Randel, W.J., and P.A. Newman, 1999: The Stratosphere in the Southern Hemisphere. Chapter 6 of the AMS Monograph *Meteorology of the Southern Hemisphere*. Published by the American Meteorological Society, pp. 243-282.

Stone, E.M., W.J. Randel and J.L. Stanford, 1999: Transport of passive tracers in baroclinic wave life cycles. *J. Atmos. Sci.*, 56, 1364-1381.

Randel, W.J., F. Wu, R. Swinbank, J. Nash, and A. O'Neill, 1999: Global QBO circulation derived from UKMO stratospheric analyses. *J. Atmos. Sci.*, 56, 457-474.

Waugh, D.W., and W.J. Randel, 1999: Climatology of Arctic and Antarctic polar vortices using elliptical diagnostics. *J. Atmos. Sci.*, 56, 1594-1613.

Randel, W.J., and F. Wu, 1999: Cooling of the Arctic and Antarctic polar stratosphere due to ozone depletion. *J. Climate*, 12, 1467-1479.

Hagan, M.E., M.D. Burrage, J.M. Forbes, J. Hackney, W.J. Randel, and X. Zhang, 1999: GSWM-98: Results for migrating solar tides. *J. Geophys. Res.*, 104, 6813-6827.

Udelhofen, P., P. Gies, C. Roy and W.J. Randel, 1999: Analysis of surface ultraviolet (UV) radiation measurements, ozone, and cloud cover over Australia. *J. Geophys. Res.*, 19135-19160.

Randel, W.J., F. Wu, J.M. Russell III and J.W. Waters, 1999: Space-time patterns of trends in stratospheric constituents derived from UARS observations. *J. Geophys. Res.*, 104, 3711-3727.

Chanin, M.-L., V. Ramaswamy, D. Gaffen, W.J. Randel, R. Rood and M. Shiotani, 1999: Trends in stratospheric temperatures. Chapter 5 of the *Scientific Assessment of Ozone Depletion: 1998*. World Meteorological Organization Report No. 44, Geneva.

Ravishankara, A.R., T.G. Shepherd, W.J. Randel, et al., 1999: Lower stratospheric processes. Chapter 7 of the *Scientific Assessment of Ozone Depletion: 1998*. World Meteorological Organization Report No. 44, Geneva.

- Randel, W.J., R.S. Stolarski, D.M. Cunnold, J.A. Logan and M.J. Newchurch and J.M. Zawodny, 1999: Trends in the vertical distribution of ozone. *Science*, 285, 1689-1692.
- Hagan, M.E., M.D. Burrage, J.M. Forbes, W.J. Randel and X. Zhang, 1999: QBO effects on the diurnal tide in the upper atmosphere. *Earth Planets Space*, 51, 571-578.
- Waugh, D.W., W.J. Randel and S. Pawson, 1999: Persistence of the lower stratospheric polar vortices. *J. Geophys. Res.*, 104, 27191-27202.
- Randel, W.J., and F. Wu, 1999: A stratospheric ozone trends data set for global modeling studies. *Geophys. Res. Lett.*, 26, 3089-3092.
- Randel, W.J., F. Wu and D. Gaffen, 2000: Interannual variability of the tropical tropopause derived from radiosonde data and NCEP reanalysis. *J. Geophys. Res.*, 105, 15509-15524.
- Pan., L., E. Hints, E.M. Stone, E. Weinstock and W. Randel, 2000: Seasonal cycle of water vapor and saturation mixing ratio in the lowermost stratosphere. *J. Geophys. Res.*, 105, 26519-26530.
- Randel, W.J., F. Wu, J.M. Russell III, J. M. Zawodny and J. Nash, 2000: Interannual changes in stratospheric constituents and global circulation derived from satellite data. AGU Monograph on *Atmospheric Science across the Stratopause*, D.E. Siskind, S.D. Eckerman and M.E. Summers, Eds., p. 271-285.
- Pawson, S., and co-authors, 2000: The GCM-Reality intercomparison project for SPARC (GRIPS): Scientific issues and initial results. *Bull. Am. Meteorol. Soc.*, 81, 781-796.
- Zhang, R., N. Sanger, R. Orville, X. Tie, W. Randel and E. Williams, 2000: Enhanced NO_x by lightning in the upper troposphere and lower stratosphere inferred from UARS global NO₂ measurements. *Geophys. Res. Lett.*, 27, 685-688.
- Gettelman, A., and co-authors, 2000: Distribution and variability of water vapor in the upper troposphere and lower stratosphere. Chapter 3 in SPARC Assessment of upper tropospheric and stratospheric water vapor. SPARC Report No. 2, 312 pp., Edited by D. Kley, J.M. Russell III and C. Phillips.
- Baldwin, M.P., L.J. Gray, T.J. Dunkerton, K. Hamilton, P.H. Haynes, W.J. Randel, J.R. Holton, et al., 2001: The Quasi-Biennial Oscillation. *Reviews of Geophysics*, 39, 179-229.
- Randel, W.J., F. Wu, A. Gettelman, J.M. Russell, J. M. Zawodny and S.J. Oltmans, 2001: Seasonal variation of water vapor in the lower stratosphere observed in Halogen Occultation Experiment data. *J. Geophys. Res.*, 106, 14313-14326.

- Gettelman, A., W.J. Randel, S. Massie, F. Wu, W.G. Read, and J.M. Russell, 2001: El Nino as a natural experiment for studying the tropical tropopause region. *J. Climate*, 14, 3375-3392.
- Ramaswamy, V., and co-authors, 2001: Stratospheric temperature trends: observations and model simulations. *Rev. Geophysics*, 39, 71-122.
- Gettelman, A., W.J. Randel, F. Wu and S. T. Massie, 2002: Transport of water vapor in the tropical tropopause layer. *Geophys. Res. Lett.*, 29, 10.1029/2001GL013818.
- Randel, W.J., 2002: Middle Atmosphere: Zonal mean climatology. Encyclopedia of Atmospheric Sciences, Academic Press, p. 1358-1365.
- Pan, L. L., W. J. Randel, H. Nakajima, S. T. Massie, H. Kanzawa, Y. Sasano, T. Yokota, and T. Sugita, S. Hayashida, and S. Oshchepkov, 2002: Satellite observation of dehydration in the Arctic Polar stratosphere, *Geophys. Res. Lett.*, 29(8), 10.1029/2001GL014147, 2002.
- Randel, W.J., R.R. Garcia and F. Wu, 2002: Time dependent upwelling in the tropical lower stratosphere estimated from the zonal mean momentum budget. *J. Atmos. Sci.*, 59, 2141-2152.
- Randel, W.J., F. Wu and R. Stolarski, 2002: Changes in column ozone correlated with the stratospheric EP flux. *J. Meteorol. Soc. Japan*, 80, 849-862.
- Randel, W.J., and 14 co-authors, 2002: SPARC Intercomparison of Middle Atmosphere Climatologies. SPARC Report No. 3, 96 pp. Edited by W. Randel, M.-L. Chanin and C. Michaut.
- Massie, S., A. Gettelman, W. Randel and D. Baumgardner, 2002: Distribution of tropical cirrus in relation to convection. *J. Geophys. Res.*, 107, 10.1029/2001JD001293.
- Pan, L.L., W.J. Randel, S. Massie, H. Kanzawa, Y. Sasano, H. Nakajima, T. Yokota and T. Sugita, 2002: Variability of polar stratospheric water vapor observed by ILAS. *J. Geophys. Res.* 107(D24), 8214, doi:10.1029/2001JD001164.
- Chipperfield, M.P., and W.J. Randel (co-lead authors), et al., 2003: Global ozone: Past and future. World Meteorological Organization (WMO) Scientific Assessment of Ozone Depletion:2002. Global Ozone Research and Monitoring Project - Report No. 47, Geneva.
- Randel, W.J., F. Wu and W. Rivera Rios, 2003: Thermal variability of the tropical tropopause region derived from GPS/MET observations. *J. Geophys. Res.*, 108, 10.1029/2002JD002595.

- Massie, S., W. Randel, F. Wu, D. Baumgardner, and M. Hervig (2003), Halogen Occultation Experiment and Stratospheric Aerosol and Gas Experiment II observations of tropopause cirrus and aerosol during the 1990s, *J. Geophys. Res.*, 108(D7), 4222, doi:10.1029/2002JD002662.
- Shine, K.P., and co-authors, 2003: A comparison of model-simulated trends in stratospheric temperatures. *Quart. J. Roy. Met. Soc.*, 129, 1565-1588.
- Logan, J. A., D. B. A. Jones, I. A. Megretskaya, S. J. Oltmans, B. J. Johnson, H. Vömel, W. J. Randel, W. Kimani, and F. J. Schmidlin (2003), Quasi-biennial oscillation in tropical ozone as revealed by ozonesonde and satellite data, *J. Geophys. Res.*, 108(D8), 4244, doi:10.1029/2002JD002170.
- Randel, W.J., and co-authors, 2004: The SPARC intercomparison of middle atmosphere climatologies. *J. Climate*, 17, 986-1003.
- Park, M., W.J. Randel, D.E. Kinnison, R.R. Garcia and W. Choi, 2004: Seasonal variation of methane, water vapor and nitrogen oxides near the tropopause: Satellite observations and model simulation. *J. Geophys. Res.*, 109, D03302, doi:10.1029/2003JD003706.
- Randel, W.J., F. Wu, S. Oltmans, K. Rosenlof and G. Nedoluha, 2004: Interannual changes of stratospheric water vapor and correlations with tropical tropopause temperatures. *J. Atmos. Sci.*, 61, 2133-2148.
- Randel, W.J., 2004: Wider connections for El Niño. *Nature*, 431, 921-923.
- Pan, L.L., W.J. Randel, B.L. Gary, M.J. Mahoney and E.J. Hints, 2004: Definitions and sharpness of the extratropical tropopause: A trace-gas perspective. *J. Geophys. Res.*, 109, D23103, doi:10.1029/2004JD004982.
- Randel, W. J., and F. Wu, 2005: Kelvin wave variability near the equatorial tropopause observed in GPS radio occultation measurements, *J. Geophys. Res.*, 110, D03102, doi:10.1029/2004JD005006.
- Seidel, D., J. Angell, A. Robock, B. Hicks, K. Labitzke, J. Lanzante, J. Logan, J. Mahlman, V. Ramaswamy, W. Randel, E. Rasmussen, R. Ross and S.F. Singer, 2005: Jim Angell's Contributions to Meteorology. *Bull. Am. Meteorol. Soc.*, 86, 403-410.
- Pyle, J., T. Shepherd, G. Bodeker, P. Canziani, M. Dameris, P. Forster, A. Gruzdev, R. Müller, N.J. Muthama, G. Pitari and W. Randel, 2005: Ozone and Climate: A Review of Interconnections. Chapter 1 in IPCC/TEAP *Special Report on Safeguarding the Ozone Layer and the Global Climate System*. Cambridge University Press, 488 pp.

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