

NEWMAN, PAUL A.

Dr. Paul A. Newman

**Chief Scientist for Earth Sciences
Earth Sciences Division
NASA Goddard Space Flight Center**

RESEARCH AREAS:

Atmospheric dynamics, Stratospheric transport, Stratospheric ozone

EDUCATION:

1984 - Ph.D. - Physics, Iowa State University, Ames, IA

1978 - B.S. - Physics, minor in Mathematics, Seattle University, Seattle, WA Magna Cum Laude

PREVIOUS POSITIONS:

2015 - , NASA, GSFC Chief Scientist for Earth Sciences

2010 - 2015 NASA, GSFC Chief Scientist for Atmospheric Sciences

1990 - 2010 NASA, GSFC AST Research Scientist

1989 - 1990 Universities Space Research Associates, GSFC

1986 - 1989 Applied Research Corp., Landover, MD

1984 - 1986 NASA Goddard Space Flight Center, Greenbelt, MD, National Research Council
Postdoctoral Fellow

1982 - 1984 Iowa State University, Ames, IA, L. H. Brown Pre-Doctoral Fellow

1978 - 1981 Iowa State University, Ames, IA, Research and Teaching Assistant in Physics

PROFESSIONAL MEMBERSHIPS AND POSITIONS:

American Meteorological Society (1979-present)

AMS Polar Meteorology and Oceanography Committee (1994)

AMS Middle Atmosphere Committee (1994)

NASA ERAST leadership team member (1994-1997)

NASA GSFC Earth Sciences Division, Scientific Advisory Group, 2014-present

Network for Detection of Stratospheric Change steering group member, 1994-2004

Member of U.S. Climate Change Science Program's Synthesis and Assessment Product 2.4:
Trends in Emissions of Ozone Depleting Substances, Ozone Layer Recovery, and
Implications for Ultraviolet Radiation Exposure (2007)

International Council of Scientific Unions (ICSU), Solar-Terrestrial Energy Program (STEP),

STEP Results, Applications, and Modeling Phase (SRAMP) Steering Committee Member
USGCRP Strategic Plan Author (2011)

Lead for the Reevaluation of the Lifetimes of Dominant Stratospheric Ozone Depleting
Substances (ODSs) activity, Stratospheric Processes And their Role in Climate (SPARC),
(2011-2014)

Lead for the Solving the Mystery of Carbon Tetrachloride activity, Stratospheric Processes And
their Role in Climate (SPARC), (2015-2018)

WMO/UNEP Scientific Assessment of Ozone Depletion: 2002, Polar Ozone Chapter lead author

WMO/UNEP Scientific Assessment of Ozone Depletion: 2006, Polar Ozone Chapter lead author

Montreal Protocol Scientific Assessment Panel, Co-Chairman (2007-2023)

Advisory committee for the General Trust Fund for Financing Activities on Research and
Systematic Observations Relevant to the Vienna Convention (2015-2023)

International Ozone Commission (2008-present)

International Ozone Commission (2016-present), Vice President

American Geophysical Union (1979-present)

Associate Editor, Journal of Geophysical Research (1997-2004)

American Geophysical Union, Atmospheric Sciences, President-elect (2019-2020)

American Geophysical Union, Atmospheric Sciences, President (2021-2022)

NEWMAN, PAUL A.

American Geophysical Union, Atmospheric Sciences, Past-President (2023-2024)

United Nations Environmental Programme Steering Committee on Monitoring Ozone Depleting Substances (2022-present)

Lead for the Hunga Tonga-Hunga Ha'apai (HTHH) Volcano Activity, Stratospheric Processes And their Role in Climate (SPARC), (2022-present)

NASA FIELD MISSIONS:

AASE theory team member (1988-1989)

AASE II theory team member (1991-1992)

SPADE theory team member (1992-1993)

ASHOE/MAESA theory team member (1994)

Stratospheric Tracers of Atmospheric Transport (STRAT) Co-Project Scientist (1994-1997)

POLARIS Co-Project Scientist (1997)

SOLVE Co-Project Scientist (1999-2000)

SOLVE-II Co-Project Scientist (2001-2002)

CRYSTAL-FACE ER-2 Platform Scientist (2002)

Pre-AVE Co-Project Scientist (2004)

AVE Project Scientist (2004-2009)

Tropical Composition, Cloud and Climate Coupling (TC4) ER-2 platform scientist (2007)

Global Hawk Pacific Mission (GloPac) project scientist (2008-2011)

Hurricane and Severe Storm Sentinel (HS3) - Deputy Project Scientist

Airborne Tropical Tropopause Experiment (ATTREX) - Global Hawk platform scientist

Southeast Asia Composition, Cloud, Climate Coupling Regional Study (SEAC4 RS) Science Team (2011-2012)

Atmospheric Tomography Mission (ATom) an Earth Venture Suborbital-2 program (2015-2019).
Science Team Lead

CARbon Atmospheric Flux Experiment (CARAFE), Deputy Project Scientist, 2015-present.

Dynamics and Chemistry of the Summer Stratosphere (DCOTSS), Science Leadership team,
2019-present

Digital Array Gas filter Radiometer (DAGR) Project Scientist (2016-2021)

Asian Summer Monsoon Chemical and Climate Impact Project (ACCLIP), Co-Project Scientist,
2017-present

AWARDS:

Magna Cum Laude, Seattle University

L. H. Brown Pre-Doctoral Fellow, Iowa State University, 1982

Premium for Academic Excellence, Iowa State University, 1984

National Research Council Postdoctoral Fellow, 1984-1986

Excellence in Reviewing award, AGU, 1993 JGR

Excellence in Reviewing Award, AGU, 1994 JGR

Alan Berman Research Publication Award, Naval Research Laboratory, 1995

Arthur S. Flemming Award, 2002

Webby Award, NASA's Ozone Watch, 2006 Official Nominee

William T. Pecora Award, Total Ozone Mapping Spectrometer Team, 2006

Ozone Protection Award, Environmental Protection Agency, 2009

Fellow of the American Geophysical Union, 2010

Bjerknes Lecture, American Geophysical Union, 2011

Fellow of the American Meteorological Society, 2012

Alumni Professional Achievement Award, Seattle University, 2012

Honorary Member, Alpha Sigma Nu, 2017

Scientific Achievement Award, Montreal Protocol, 2017

Champion of the Earth, United Nations Environment, 2017

NEWMAN, PAUL A.

Charney Lecture, American Geophysical Union, 2018
Cleveland Abbe Award, American Meteorological Society, 2021.

NASA AWARDS:

Group Achievement Award (AASE I), 1989
Group Achievement Award (Ozone Trends Panel), 1989
Group Achievement Award (Temperature Analysis Group), 1990
GSFC Laboratory for Atmospheres Peer Award, 1991
Group Achievement Award (AASE II), 1992
Group Achievement Award (Stratospheric Forecasting), 1994
Group Achievement Award (SPADE), 1994
Group Achievement Award (ASHOE/MAESA), 1995
Group Achievement Award (POLARIS), 1998
GSFC Special Act Award (SOLVE), 2000
GSFC Laboratory for Atmospheres Peer Award, 2001
Group Achievement Award (SOLVE II), 2004
Group Achievement Award (SOLVE II DC-8 Science Team), 2005
GSFC Laboratory for Atmospheres Peer Award, 2006 GSFC
Group Achievement Award (TOMS), 2006
Group Achievement Award (TC-4 Science Team), 2008
William Nordberg Memorial Award for Earth Sciences, 2011
Group Achievement Award (GloPac Science Team), 2011
Senior Fellow, Goddard Space Flight Center, 2014
Robert H. Goddard Exceptional Achievement for Science Team, Chelyabinsk Bolide, 2014.
Group Achievement Award (SEAC4RS), 2014.
Group Achievement Award (HS3), 2015.
Group Achievement Award (ATTREX), 2016.
Distinguished Service Medal, 2017
Group Achievement Award (ATom), 2019.

NEWMAN, PAUL A.

PUBLICATIONS (updated 18 March 2021): Web of Science h-index 53; Google Scholar h-index 66 and i10-index 205 (since 2016, h-index 35, i10-index 101).

1. "Observational Characteristics of Atmospheric Anomalies with Short Meridional and Long Zonal Scales," P. A. Newman and J. L. Stanford, *J. Atmos. Sci.*, **40**, 2547-2554, [https://doi.org/10.1175/1520-0469\(1983\)040<2547:OCOAAW>2.0.CO;2](https://doi.org/10.1175/1520-0469(1983)040<2547:OCOAAW>2.0.CO;2), 1983.
2. "Short Meridional Scale Anomalies in the Lower Stratosphere and Upper Troposphere," P. A. Newman and J. L. Stanford, *J. Atmos. Sci.*, **42**, 2081-2092, [https://doi.org/10.1175/1520-0469\(1985\)042<2081:SMSAIT>2.0.CO;2](https://doi.org/10.1175/1520-0469(1985)042<2081:SMSAIT>2.0.CO;2), 1985.
3. "Nimbus 7 Satellite Measurements of the Springtime Antarctic Ozone Decrease," R. S. Stolarski, A. J. Krueger, M. R. Schoeberl, R. D. McPeters, P. A. Newman, and J. C. Alpert, *Nature*, **322**, 808-811, <https://doi.org/10.1038/322808a0>, 1986.
4. "Horizontal Mixing Coefficients Calculated from NMC Data," P. A. Newman, M. R. Schoeberl, and R. A. Plumb, *J. Geophys. Res.*, **91**, 7919-7924, <https://doi.org/10.1029/JD091iD07p07919>, 1986.
5. "The Morphology of Antarctic Total Ozone as Seen by TOMS," M. R. Schoeberl, A. J. Krueger, and P. A. Newman, *Geophys. Res. Lett.*, **13**, 1217-1220, 1986.
6. "October Antarctic Temperature and Total Ozone Trends from 1979-1985," P. A. Newman and M. R. Schoeberl, *g.*, **13**, 1206-1209, 1986.
7. "The Final Warming and Polar Vortex Disappearance During the Southern Hemisphere Spring," P. A. Newman, *Geophys. Res. Lett.*, **13**, 1228-1231, 1986.
8. "Antarctic Springtime Ozone Depletion Computed from Temperature Observations," J. E. Rosenfield, M. R. Schoeberl, and P. A. Newman, *J. Geophys. Res.*, **93**, 3833-3849, 1988.
9. "The Morphology and Meteorology of Southern Hemisphere Spring Total Ozone Mini-Holes," P. A. Newman, L. R. Lait, and M. R. Schoeberl, *Geophys. Res. Lett.*, **15**, 923-926, 1988.
10. "Mixing Rates Calculated from Potential Vorticity," P. A. Newman, M. R. Schoeberl, R. A. Plumb, and J. E. Rosenfield, *J. Geophys. Res.*, **93**, 5221-5240, 1988.
11. "Effect of Computed Horizontal Diffusion Coefficients on Two-Dimensional N₂O Model Distributions," C. H. Jackman, P. A. Newman, P. D. Guthrie, and M. R. Schoeberl, *J. Geophys. Res.*, **93**, 5213-5219, 1988.
12. "Coherent Ozone-Dynamical Changes during the Southern Hemisphere Spring, 1979-1986," P. A. Newman, and W. J. Randel, *J. Geophys. Res.*, **93**, 12,585-12,606, 1988.
13. "Quasi-biennial Modulation of the Antarctic Ozone Depletion," L. R. Lait, M. R. Schoeberl, and P. A. Newman, *J. Geophys. Res.*, **94**, 11,559-11,571, 1989.
14. "Potential Vorticity Estimates in the South Polar Vortex from ER-2 Flight Data," D.L. Hartmann, K. R. Chan, B. L. Gary, M. R. Schoeberl, P. A. Newman, R. L. Martin, M. Loewenstein, J. R. Podolske, and S. E. Strahan, *J. Geophys. Res.*, **94**, 11625-11640, 1989.
15. "Evidence of the Mid-Latitude Impact of Antarctic Ozone Depletion," R. J. Atkinson, W. A. Mathews, P. A. Newman, and R. A. Plumb, *Nature*, **340**, 290-293, 1989.
16. "Reconstruction of the Constituent Distribution and Trends in the Antarctic Polar Vortex from ER-2 Flight Observation," M. R. Schoeberl, L. R. Lait, M. Proffitt, P. A. Newman, R. L. Martin, D. L. Hartmann, M. Loewenstein, J. Podolske, S. E. Strahan, J. Anderson, K. R. Chan, and B. Gary, *J. Geophys. Res.*, **94**, 16815-16846, 1989.
17. "The 1989 Antarctic Ozone Hole as observed by TOMS," R. S. Stolarski, M. R. Schoeberl, P. A. Newman, R. D. McPeters, A. J. Krueger, *Geophys. Res. Lett.*, **17**, 1267-1270, [HTTPS://DOI.ORG/10.1029/GL017i009p01267](https://doi.org/10.1029/GL017i009p01267), 1990.
18. "ER-2 Mountain Wave Encounter Over Antarctica: Evidence for Blocking," J. T. Bacmeister, M. R. Schoeberl, L. R. Lait, P. A. Newman, and B. Gary, *Geophys. Res. Lett.*, **17**, 1990.
19. "Comparison of Ozone Profiles from Ground-Based Lidar, ECC Balloon Sonde, ROCOZ-A Rocketsonde, and SAGE II Satellite Measurements," I. S. McDerimid, R. A. Barnes, C. L. Parsons, A. Torres, M. P. McCormick, W. P. Chu, P. Wang, J. Butler, P. Newman, J. Burris, R. Ferrare, D. Whiteman, and T. J. McGee, *J. Geophys. Res.*, **95**, 10,037-10,042, 1990.

NEWMAN, PAUL A.

20. "Loss of Ozone in the Arctic Vortex for the Winter of 1989," R. Salawitch, M. McElroy, J. Yatteau, S. Wofsy, M. Schoeberl, L. Lait, P. Newman, K. Chan, M. Loewenstein, J. Podolske, S. Strahan, and M. Proffitt, *Geophys. Res. Lett.*, **17**, 561-564, 1990.
21. "Stratospheric Constituent Trends from ER-2 Profile Data," M. Schoeberl, M. Proffitt, K. Kelly, L. Lait, P. Newman, J. Rosenfield, M. Loewenstein, J. Podolske, S. Strahan, and J. Vedder, *Geophys. Res. Lett.*, **17**, 469-472, 1990.
22. "Reconstruction of O₃ and N₂O Fields from ER-2, DC-8, and Balloon Observations," L. R. Lait, M. R. Schoeberl, P. A. Newman, M. H. Proffitt, K. K. Kelly, M. Loewenstein, J. R. Podolske, S. E. Strahan, K. R. Chan, B. Gary, J. Margitan, E. Browell, M. P. McCormick, and A. Torres, *Geophys. Res. Lett.*, **17**, 521-524, 1990.
23. "Airborne Measurements of Stratospheric Constituents Over the Arctic in the Winter of 1989," W. Mankin, M. Coffey, A. Goldman, M. Schoeberl, L. Lait, and P. Newman, *Geophys. Res. Lett.*, **17**, 473-476, 1990.
24. "A Comparison of Arctic Lower Stratospheric Winter Temperatures for 1988-89 with Temperatures Since 1964," R. M. Nagatani, A. J. Miller, M. E. Gelman, and P. A. Newman, *Geophys. Res. Lett.*, **17**, 333-336, 1990.
25. "Small-Scale Waves Encountered during AASE," J. T. Bacmeister, M. R. Schoeberl, L. R. Lait, P. A. Newman, B. Gary, *Geophys. Res. Lett.*, **17**, 349-352, 1990.
26. "Three Dimensional Simulation of Hydrogen Chloride and Hydrogen Fluoride during the Airborne Arctic Stratospheric Expedition," J. A. Kaye, A. R. Douglass, R. B. Rood, R. S. Stolarski, P. A. Newman, D. J. Allen, E. M. Larson, M. T. Coffey, W. G. Mankin, and G. C. Toon, *Geophys. Res. Lett.*, **17**, 529-532, 1990.
27. "Stratospheric Temperatures During AASE: Results From STRATAN," R. B. Rood, P. A. Newman, D. J. Lamich, L. R. Lait, and R. Chan, *Geophys. Res. Lett.*, **17**, 337-340, 1990.
28. "Radiative Heating Rates during the Airborne Arctic Stratospheric Expedition," J. E. Rosenfield, M. R. Schoeberl, L. R. Lait, P. A. Newman, M. H. Proffitt, and K. K. Kelly, *Geophys. Res. Lett.*, **17**, 345-348, 1990.
29. "Total Ozone during the 1988-1989 Northern Hemisphere Winter," P. A. Newman, R. S. Stolarski, M. R. Schoeberl, L. R. Lait, and A. J. Krueger, *Geophys. Res. Lett.*, **17**, 317-320, 1990.
30. "Stratospheric Temperatures During the 88-89 Northern Hemisphere Winter," P. A. Newman, L. R. Lait, M. R. Schoeberl, and R. M. Nagatani, *Geophys. Res. Lett.*, **17**, 329-332, 1990.
31. "Effects of Atmospheric Transport on Column Abundances of Nitrogen and Chlorine Compounds in the Arctic Stratosphere," J. Yatteau, S. Wofsy, R. Salawitch, M. McElroy, M. Schoeberl, L. Lait, P. Newman, A. Torres, T. Jorgensen, W. Mankin, M. Coffey, G. Toon, M. Loewenstein, J. Podolske, S. Strahan, K. Chan, and M. Proffitt, *Geophys. Res. Lett.*, **17**, 533-536, 1990.
32. "Lidar Observations of Ozone Changes induced by subpolar air-mass motion over Table Mountain, California (34.4°N)," T. J. Mcgee, R. Ferrare, J. Butler, P. Newman, D. Whiteman, J. Burris, S. Godin, and I. S. McDermid, *J. Geophys. Res.*, **95**, 20,527-20,530, 1990.
33. "The 1990 Antarctic Ozone Hole as Observed by TOMS," P. Newman, R. Stolarski, M. Schoeberl, R. McPeters, and A. Krueger, *Geophys. Res. Lett.*, **18**, 661-664, 1991.
34. "Depletion of Arctic Ozone in the Winter 1990," M. Koike, Y. Kondo, M. Hayashi, Y. Iwasaka, P. A. Newman, M. Helten, P. Amedieu, *Geophys. Res. Lett.*, **18**, 791-794, 1991.
35. "Spatial and Temporal Variability of the Extent of Chemically Processed Stratospheric Air," J. A. Kaye, A. R. Douglass, R. B. Rood, R. S. Stolarski, P. A. Newman, D. J. Allen, and E. M. Larson, *Geophys. Res. Lett.*, **18**, 29-32, 1991.
36. "Reactive Nitrogen, Ozone, and Nitrate Aerosols Observed in the Arctic Stratosphere in January 1990," Y. Kondo, P. Amedieu, M. Koike, Y. Iwasaka, P. A. Newman, U. Schmidt, and W. A. Matthews, *J. Geophys. Res.*, **97**, 13,025-13,038, 1991.
37. "Long-term Winter Total Ozone Changes at Macquarie Island," P. Lehmann, D. J. Karoly, P. A. Newman, T. S. Clarkson, and W. A. Matthews, *Geophys. Res. Lett.*, **19**, 1459-1462, 1992.
38. "An investigation into the causes of stratospheric ozone loss in the southern australasian region," P. Lehmann, D. J. Karoly, P. A. Newman, T. S. Clarkson, and W. A. Matthews, *Geophys. Res. Lett.*, **14**, 1463-1466, 1992.

NEWMAN, PAUL A.

39. "The 1991 Antarctic Ozone Hole: TOMS Observations," A. Krueger, M. Schoeberl, P. Newman, and R. Stolarski, *Geophys. Res. Lett.*, **12**, 1215-1218, 1992.
40. "The Structure of the Polar Vortex," M. R. Schoeberl, L. R. Lait, P. A. Newman, J. E. Rosenfield, *J. Geophys. Res.*, **97**, 7859-7882, 1992.
41. "Evidence for Subsidence in the 1989 Arctic Winter Stratosphere from Airborne Infrared Composition Measurements," G. C. Toon, C. B. Farmer, P. W. Schaper, L. L. Lowe, R. H. Horton, M. R. Schoeberl, L. R. Lait, and P. A. Newman, *J. Geophys. Res.*, **97**, 7963-7970, 1992.
42. "Record Low Global Ozone in 1992," J. Gleason, P. K. Bhartia, J. R. Herman, R. McPeters, P. Newman, R. S. Stolarski, L. Flynn, G. Labow, D. Larko, C. Seftor, C. Wellemeyer, W. D. Komhyr, A. J. Miller, and W. Planet, *Science*, **260**, 523-526, 1993.
43. "Chlorine Chemistry on Polar Stratospheric Cloud Particles in the Arctic Winter," C. R. Webster, R. D. May, D. W. Toohey, L. M. Avallone, J. G. Anderson, P. Newman, L. Lait, M. R. Schoeberl, J. W. Elkins, and K. R. Chan, *Science*, **261**, 1130-1134, 1993.
44. "Chemical Loss of Ozone in the Arctic Polar Vortex in the Winter of 1991-1992," R. J. Salawitch, C. F. Wofsy, E. W. Gottlieb, D. W. Toohey, L. M. Avallone, L. R. Lait, P. A. Newman, M. R. Schoeberl, M. Loewenstein, J. R. Podolske, S. E. Strahan, A. Weaver, M. H. Proffitt, C. R. Webster, R. D. May, D. W. Fahey, D. Baumgardner, J. E. Dye, J. C. Wilson, K. K. Kelly, J. W. Elkins, K. R. Chan, and J. G. Anderson, *Science*, **261**, 1146-1149, 1993.
45. "The Seasonal Evolution of Reactive Chlorine in the Northern Hemisphere Stratosphere," D. W. Toohey, L. M. Avallone, L. R. Lait, P. A. Newman, M. R. Schoeberl, D. W. Fahey, C. R. Webster, R. D. May, and J. G. Anderson, *Science*, **261**, 1134-1136, 1993.
46. "Heterogeneous Reaction Probabilities, Solubilities, and Physical State of Cold Volcanic Aerosols," O. Toon, B. Gary, L. Lait, P. Newman, R. Pueschel, P. Russell, M. Schoeberl, G. Toon, W. Traub, F. Valero, H. Selkirk, and J. Jordan, *Science*, **261**, 1136-1140, 1993.
47. "Stratospheric meteorological conditions in the Arctic polar vortex, 1991 to 1992," P. Newman, L. Lait, M. Schoeberl, E. Nash, K. Kelly, D. W. Fahey, R. Nagatani, D. Toohey, J. Anderson, and L. Avallone, *Science*, **261**, 1143-1146, 1993.
48. "MLS ClO Observations and Arctic Polar Vortex Temperatures," M. R. Schoeberl, R. S. Stolarski, A. R. Douglass, P. A. Newman, L. R. Lait, J. W. Waters, L. Froidevaux, W. G. Ready, *Geophys. Res. Lett.*, **20**, 2861-2864, 1993.
49. "A Simulation of the Cerro Hudson SO₂ Cloud," M. R. Schoeberl, S. Doiron, L. R. Lait, P. A. Newman, and A. J. Krueger, *J. Geophys. Res.*, **98**, 2949-2955, 1993.
50. "New Observations of the NO_y/N₂O Correlation in the Lower Stratosphere," M. Loewenstein, J. R. Podolske, D. W. Fahey, E. L. Woodbridge, P. Tin, A. Weaver, P. A. Newman, S. E. Strahan, S. R. Kawa, M. R. Schoeberl, and L. R. Lait, *Geophys. Res. Lett.*, **20**, 2531-2534, 1993.
51. "Interpretation of NO_x/NO_y Observations from AASE-II Using a Model of Chemistry Along Trajectories," S. R. Kawa, D. W. Fahey, J. C. Wilson, M. R. Schoeberl, A. R. Douglass, R. S. Stolarski, E. L. Woodbridge, H. Jonsson, L. R. Lait, P. A. Newman, M. H. Proffitt, D. W. Toohey, D. E. Anderson, M. Loewenstein, K. R. Chan, C. R. Webster, R. May, and K. K. Kelly, *Geophys. Res. Lett.*, **20**, 2507-2510, 1993.
52. "Post-Pinatubo optical depth spectra vs latitude and vortex structure - airborne tracking sunphotometer measurements in AASE-II", P. B. Russell, J. M. Livingston, R. F. Pueschel, J. A. Reagan, E. V. Browell, G. C. Toon, P. A. Newman, M. R. Schoeberl, L. R. Lait, L. Pfister, Q. Gao, B. M. Herman, *Geophysical Research Letters*, **20** (22), 2571-2574, <https://doi.org/10.1029/93GL03006>, 1993.
53. "The Evolution of ClO and NO along Air Parcel Trajectories," M. R. Schoeberl, A. R. Douglass, R. S. Stolarski, P. A. Newman, L. R. Lait, D. Toohey, L. Avallone, J. G. Anderson, W. Brune, D. W. Fahey, and K. Kelly, *Geophys. Res. Lett.*, **20**, 2511-2514, 1993.
54. "Antarctic Total Ozone in 1958," P. A. Newman, *Science*, **264**, 543-546, 1994.
55. "A Comparison of Winds From the STRATAN Data Assimilation System to Balanced Wind Estimates", L. Coy, R. Rood, P. Newman, *J. Atmos. Sci.*, **51**, 2309-2315, 1994.
56. "Computations of Diabatic Descent in the Stratospheric Polar Vortex," J. E. Rosenfield, P. A. Newman, and M. R. Schoeberl, *J. Geophys. Res.*, **99**, 16677-16689, 1994.

NEWMAN, PAUL A.

57. "Correlation of Ozone Loss with the Presence of Volcanic Aerosols," T. McGee, M. Gross, U. Singh, P. Newman, G. Megie, S. Godin, and A. Locoste, *Geophys. Res. Lett.*, **21**, 2801-2804, 1994.
58. "Transport Out of the Lower Stratospheric Arctic Vortex by Rossby Wave Breaking," D. W. Waugh, R. A. Plumb, R. J. Atkinson, M. R. Schoeberl, L. R. Lait, P. A. Newman, M. Loewenstein, D. W. Toohey, L. M. Avallone, C. R. Webster, and R. D. May, *J. Geophys. Res.*, **99**, 1071-1088, 1994.
59. "Intrusions Into the Lower Stratospheric Arctic Vortex During the Winter of 1991-1992," R. A. Plumb, D. W. Waugh, R. J. Atkinson, P. A. Newman, L. R. Lait, M. R. Schoeberl, E. V. Browell, A. J. Simmons, and M. Loewenstein, *J. Geophys. Res.*, **99**, 1089-1105, 1994.
60. "UARS MLS O₃ Soundings Compared with Lidar Measurements Using the Conservative Coordinates Reconstruction Technique," G. Redaelli, L. R. Lait, M. Schoeberl, P. A. Newman, G. Visconti, A. D'Altorio, F. Masci, V. Rizi, L. Froidevaux, J. W. Waters, and A. J. Miller, *Geophys. Res. Lett.*, **21**, 1535-1538, 1994.
61. "An Algorithm for Forecasting Mountain Wave-Related Turbulence in the Stratosphere," J. T. Bacmeister, P. A. Newman, B. L. Gary, and K. R. Chan, *Weather and Forecasting*, **9**, 241-253, 1994.
62. "Fine-Scale, Poleward Transport of Tropical Air During AASE 2," D. W. Waugh, R. A. Plumb, P. A. Newman, M. R. Schoeberl, L. R. Lait, M. Loewenstein, J. R. Podolske, J. W. Elkins, and K. R. Chan, *Geophys. Res. Lett.*, **21**, 2603-2606, 1994.
63. "Trajectory Mapping of Upper Atmosphere Research Satellite (UARS) Data," G. A. Morris, M. R. Schoeberl, L. Sparling, P. A. Newman, L. R. Lait, L. Elson, J. Waters, R. A. Suttie, A. Roche, J. Kumer, and J. M. Russell, III, *J. Geophys. Res.*, **100**, 16,491-16,505, 1995.
64. "Meteor-3/TOMS Observations of the 1994 Ozone Hole," J. Herman, P. Newman, D. Larko, C. Wellemeyer, *Geophys. Res. Lett.*, **22**, 3227-3229, 1995.
65. "A Multiple Level Trajectory Analysis of Vortex Filaments," M. R. Schoeberl and P. A. Newman, *J. Geophys. Res.*, **100**, 25,801-25,815, 1995.
66. "Meteor-3 Total Ozone Mapping Spectrometer Observations of the 1993 Ozone Hole", J. Herman, P. Newman, R. McPeters, A. Krueger, P. Bhartia, C. Seftor, O. Torres, G. Jaross, R. Cebula, D. Larko, C. Wellemeyer, *J. Geophys. Res.*, **100**, 2973-2983, 1995.
67. "Trajectory Modelling of Emissions from Lower Stratospheric Aircraft," L. Sparling, M. Schoeberl, A. Douglass, C. Weaver, P. Newman, and L. Lait, *J. Geophys. Res.*, **100**, 1427-1438, 1995.
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