

Richard B. Rood

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Narrative Summary: Richard Rood is a Professor in the Department of Atmospheric, Oceanic and Space Sciences and in the School of Natural Resources and the Environment at the University of Michigan. He teaches dynamical meteorology and physical climate. In 2006 he initiated a cross-discipline graduate course on climate change, which addresses critical analysis and complex problem solving. This course has attracted students from six colleges and nine departments in the University. As a member of the Senior Executive Service at the National Aeronautics and Space Administration (NASA), Rood received recognition for his ability to lead both scientific and high performance computing activities. His scientific background includes investigations of the interaction of atmospheric dynamics and chemistry, computational fluid dynamics, climate and chemical data assimilation, and process-based analysis of models and observations. Rood's current research is focused on the use of science-based knowledge of the Earth's climate in societal applications and policy. He is a Fellow of the American Meteorological Society and a winner of the World Meteorological Organization Norbert Gerbier Award. He writes an expert blog on climate change for the Weather Underground (wunderground.com) and on climate policy for the American Meteorological Society.

CURRENT POSITION:

2010 - : Professor, Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI; Professor, School of Natural Resources and the Environment, University of Michigan, Ann Arbor, MI

2005 - 2010: Professor, Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI

Ancillary and consulting:

2009 : Consultant, World Bank

2007 - : Expert Content Provider, Wunderground.com, <http://www.wunderground.com/>

PREVIOUS POSITIONS:

2005 - 2005: Chief, Computational and Information Sciences and Technology Office, NASA/Goddard Space Flight Center, Greenbelt, MD

2004 - 2005: Visiting Scientist (Intergovernmental Personnel Act Mobility Program), Lawrence Livermore National Laboratory, Livermore, CA

2001 - 2005: Chief, Earth and Space Data Computing Division, NASA/Goddard Space Flight Center, Greenbelt, MD

2001 - 2002: Acting Director, NOAA/NASA Joint Center for Satellite Data Assimilation

1998 - 2001: Senior Scientist, Data Assimilation Office, NASA/Goddard Space Flight Center, Greenbelt, MD

1992 - 1998: Head, Data Assimilation Office, NASA/Goddard Space Flight Center, Greenbelt, MD

1986 - 1992: AST, Atmospheric Chemistry and Dynamics, NASA/Goddard Space Flight Center, Greenbelt, MD

1984 - 1986: Assistant Scientist, Applied Research Corporation, Landover, MD (at NASA/Goddard Space Flight Center, Greenbelt, MD)

1982 - 1984: NAS/NRC Research Associate, NASA/Goddard Space Flight Center, Greenbelt, MD

1979 - 1982: Research Assistant, Plasma Physics Division, Science Applications Inc., McLean, VA (at Naval Research Laboratory, Washington, DC)

EDUCATION:

1982: Ph.D., *Meteorology*, Florida State University, Tallahassee, FL

1979: M.S., *Meteorology*, Florida State University, Tallahassee, FL

1976: B.S., *Physics*, University of North Carolina, Chapel Hill, NC

PROFESSIONAL SOCIETY MEMBERSHIPS:

American Meteorological Society (Fellow)

American Geophysical Union

AWARDS:

2004: American Meteorological Society, Elected Fellow

2003: World Meteorological Organization Norbert Gerbier Award

2000: NASA Outstanding Leadership Medal

1995: NASA Exceptional Achievement Medal

1982: National Research Council Postdoctoral Fellowship

Numerous internal NASA awards for participation in scientific missions and for performance. Details available on request.

CURRENT FUNDED PROPOSALS:

“Subgrid-Scale Mixing in Climate Models: A Novel Look at Diffusion, Accuracy, Stability, and Climate Sensitivity,” Department of Energy (R. Rood, PI; C. Jablonowski, Co-PI, July 1, 2007 – June 30, 2011, ~\$996K)

“Process-Based and Object-Based Investigation of Bias in Simulations of the Physical Climate,” NASA (R. Rood, PI, January 1, 2008-December 31, 2010, ~\$1,125K)

“Climate change, heatwaves and health: Local tools for sustainability, equity and prevention,” Graham Environmental Sustainability Institute (M. S. O’Neill (School of Public Health) PI; R. Rood, Co-PI, April, 2008-March, 2010, ~\$175K)

“Reducing Social Disparities of Heatwave Impacts in a Changing Climate,” Centers for Disease Control and Prevention (M. S. O’Neill (School of Public Health) PI, September, 2008-August, 2011, ~\$1,300K)

“Scaling up: Introducing Commoditized Governance into Community Earth Science Modeling,” National Science Foundation (C. M. DeLuca (National Center for Atmospheric Research) PI, February, 2010-January, 2014, ~\$2,500K)

“Great Lakes Regional Integrated Sciences and Assessments Center,” National Oceanic and Atmospheric Administration (D. Scavia (Graham Environmental Sustainability Institute) PI, July, 2010-June, 2015, ~\$4,000K)

TEACHING and STUDENTS:

Atmospheric, Oceanic, and Space Science 480 / Natural Resources and Environment 480: Climate Change: The Move to Action. This is a course focused on complex problem solving at the intersection of climate science, business, policy, public health, ethics, etc. Started in 2006, the course has attracted graduate students from 9 departments in 6 schools.

http://climateknowledge.org/classes/index.php/Climate_Change:_The_Move_to_Action

Atmospheric, Oceanic, and Space Science 401: Geophysical Fluids Dynamics. This is a course in atmospheric dynamics for majors.

http://climateknowledge.org/classes/index.php/Dynamical_Meteorology

Atmospheric, Oceanic, and Space Science 605: Quikclimate: Water in the Atmosphere, Winter 2008.

Atmospheric, Oceanic, and Space Science 605: Quikclimate: General Circulation and Wave-mean flow interaction, Fall 2008.

SHORT COURSES:

Lecturer, World Climate Research Program, *Tutorial Symposium on Global Tracer Transport Modeling*, Bermuda (1991)

Lecturer and Keynote Speaker, NATO Advanced Study Institute Summer School, *Data Assimilation for the Earth System*, Acquafredda, Italy (2002)

Lecturer, International Summer School of Atmospheric and Oceanic Sciences, *The Need for Observing Systems of Atmospheric Composition*, L'Aquila, Italy (2004)

Lecturer, Modeling of Global Chemistry for Climate Project Summer School, *Use of Models for the Interpretation of Atmospheric Measurements*, Banff, Canada (2005)

Lecturer, Summer Colloquia 2006 (Advanced Study Program and the Climate and Global Dynamics Division of NCAR), *The Art of Climate Modeling*, Boulder, Colorado, USA (2006)

Lecturer, Third ENVISAT Summer School, *Earth System Monitoring and Modeling*, Frascati, Italy (2006)

Lecturer, *Numerical Techniques for Global Atmospheric Models*, Boulder, Colorado, USA (2008)

GRADUATE STUDENTS:

Students prior to University of Michigan:

Glen Schuster (MS, Florida State, 1988; *Total Southern Hemisphere Ozone, 1978-1987: The Quasi-Biennial Oscillation*)

Rebecca Orris (Ph. D., Princeton, 1997; *Ozone and Temperature: A Test of the Consistency of Models and Observations in the Middle Atmosphere*)

Dale J. Allen (Ph. D., Maryland, 1996; *The Effects of Transport and Convection on the Global Atmospheric Distribution of Trace Species as Determined by a Chemistry and Transport Model*)

William Putman (Ph. D., Florida State University, 2007; *Development of the Finite-Volume Dynamical Core on the Cubed Sphere*)

Advisor: University of Michigan

Evan Oswald, *Urban heat and human health* (2009 – present)

M. Soner Yorgen, *Geospatial statistics and meteorological realism* (2008 – present)

Erika Roesler, *Investigation of Aerosol-Cloud Interactions in a Cloud Resolving Model for Comparison to Observed Satellite Data Retrievals*, (2007- present, Joint with J. Penner)

Jared Whitehead (Applied Mathematics), *Sub-scale mixing in finite-volume numerical schemes* (2007-present)

Gabriel Thoumi, *Avoided Deforestation: Carbon trading, Climate, Conservation, and Sustainability* (2007- 2009, Masters of Business Administration)

Cedric Drui, *Environmental Risk Assessment*, (2006-2007, Masters of Science)

Thesis Committees:

Paul Ullrich (Atmospheric, Oceanic, and Space Sciences), *Atmospheric Modeling with High-Order Finite-Volume Methods* (2011)

Andrew Winkelman (Natural Resources and Environment), *The Clean Development Mechanism and Least Developed Countries: Key Determinants for Enhancing Climate Change Mitigative Capacity through Case Study Analysis in Niger* (2009-2011)

Shanna Shaked (Applied Physics), *Multi-Continental Multimedia Model of Pollutant Intake and Application to Impacts of Global Emissions and Globally Traded Goods* (2008-2011)

Christine Kirchhoff (Natural Resources and Environment), *The Formation of Stakeholder Networks: Linking Assessments and Decision Making in Adaptive Integrative Management* (2006-2010)

Jasper Kok (Applied Physics), *Understanding Wind-Blown Sand and the Electrification of Granular Systems* (2007-2009)

Sharon Gourджи (Civil and Environmental Engineering), *Global grid-scale CO₂ flux estimation, regional application of geostatistical inverse modeling for North America, and carbon management and strategies for maintaining long-lived terrestrial carbon sinks* (2007-2011)

Su-Ting Cheng (Natural Resources and Environment), *A Stream Temperature Model and its Applications* (2006-2010)

Cheng Zhou (Atmospheric, Oceanic, and Space Sciences), *Linear and nonlinear Kelvin waves/tropical instability waves in the shallow-water system* (2010)

Minghuai Wang (Atmospheric, Oceanic, and Space Sciences), *Aerosol indirect effects in a coupled global aerosol and atmospheric circulation model* (2009)

Alanood Alkhaled (Civil and Environmental Engineering), *Remote Sensing of CO₂: Geostatistical Tools for Assessing Spatial Variability, Quantifying Representation Errors, and Gap Filling*, (2007-2009)

Huan Guo (Atmospheric, Oceanic, and Space Sciences), *Examining Aerosol Direct and Indirect Effects Using a Radiative Transfer Model and a Cloud Resolving Model* (2007)

SPECIAL EXPERIENCE:

Principal Investigator: NASA: Earth Observing System Program; High Performance Computing and Communications Program; Atmospheric Chemistry Modeling and Analysis Program; Atmospheric Effects of Aviation Program; Modeling, Analysis and Prediction Program. Department of Energy: Biological and Environmental Research Program.

Competed and won research proposals at all levels- as high as \$18M per year.

Professional Societies: AMS Committee on Middle Atmosphere (1988-1994, Chairman 1992-1994); Associate Editor, *Geophysical Research Letters* (1989-1993); Editor, Journal of the Atmospheric Sciences (1993-1996; UARS Special Issue, 1994)

University Committees: Departmental: Information Technology Committee (Chair), 2005-present); Faculty Search Committee (2005-2006, Chair); Faculty Search Committee (2007-2008, 2009-2010, 2010-2011), Strategic Planning Committee (2007-2008, Chair), Undergraduate Curriculum Committee (2008-2009), Applied Climate Curriculum Development (2009-2010), Mentoring Committee (2009-). College of Engineering: Research Computing for Engineering Committee (2007), Awards Committee (2007). University: Research Cyber-infrastructure Committee (2006-2007), University of Michigan Delegation to Conference of Parties, Copenhagen (2009, Delegation Lead)

Notable Special Assignments: *Ad hoc* committee on Interagency Climate Modeling (L. Gates, Chair, report to US Global Change Research Program, 1998-2000), *Ad hoc* Task Group on Climate Modeling and Computing Requirements (D. Evans, Chair, report to J. Baker, NOAA and, 1999-2000), Detailed to NASA Headquarters (NASA Strategy on Modeling and Supercomputing, 2000), National Research Council Board on Competitiveness of U.S. Climate Modeling (National Academy of Science, 2000), White House Office of Science and Technology Policy (Lead Author on Plan for National Climate Modeling and Associated Supercomputing, 2000-2001), Delegate U.S. - Italy Joint Climate Research Initiatives (Dept. of State, President's Office of Science and Technology Policy, 2002), Delegate U.S. - Japan Joint Climate Research Initiatives (Dept. of State, President's Office of Science and Technology Policy, 2002), University of Michigan Representative to University Corporation of Atmospheric Research (2006-present), National Research Council Study Committee, A National Strategy for Advancing Climate Modeling (2011 -).

External Review and Advisory Panels: International Review Committee for the Networks of Centers of Excellence (Natural Sciences and Engineering Research Council of Canada, 1989); Review Board for NASA Graduate Student Research Program (1990, 1991); Merit Review Board for NASA Historically Black College and University Program (1991); ERA-40 External Advisory Panel (European Center for Medium-range Weather Forecasts, 1997-2001); Computing Sciences Review Committee (Lawrence Berkeley National Laboratory, 1999); Center for Computational Sciences Review Committee (Oak Ridge National Laboratory, 2000); Climate, Ocean, and Sea Ice Modeling Project External Review Panel (Los Alamos National Laboratory, 2002); Community Climate System Model Advisory Board (National Center for Atmospheric Research, 2005-2011); Naval Research Laboratory Atmospheric Sciences External

Review (2006), Board of Directors, Canadian-Stratospheric Processes and their Role in Climate (2006-2010), External Review NOAA Climate Research and Modeling Program (2008)

Computing and Data Center Panels: NASA OSO/OSSA Committee on Supercomputing (1989), Goddard Space Flight Center (GSFC) Strategic Planning Task Group on *GSFC's Role as a Science Data and Information Center* (1991), Office of Space Science and Applications Supercomputer Requirements at NASA/GSFC (with Michele Rienecker, 1992), Earth Sciences Directorate/National Meteorological Center (NMC) Technical Implementation Agreement on Data Exchange (Principal Author, with Wayman Baker, NMC, 1993), Computer Environment and Research Requirements Committee (1994), EOSDIS Advisory Panel (1994 – 1998)

Speaker: Contributed and Invited Speaker at national and international conferences since 1979; Regular speaker at universities and government laboratories in the U.S. and Europe; Keynote Speaker, *Earth Systems Processes Conference* (Geological Society of London), Edinburgh, Scotland (2001); Dinner Speaker, *Climate Change Science Program* (Dept. of Energy), Seattle, WA (2004)

Assessment Activities: Participant in United Nations Environment Program and U.S. assessment activities on the state of atmospheric ozone and the environmental impact of aircraft. Lead author and co-author in assessment reports (1989-1995)

Educational Activities: Directed *Multimedia Monsoon Project* (Reviewed and approved for high school curriculum and general distribution by NASA Education Office, 1996)

Outside of the Workplace Activities: Writer of short stories, essays, and poems – published in *Night Music*, *Faultline*, *Foreign Service Journal* (*Summer Fiction Winner, 2004*), *Arnazella* // President Cape Anne Citizens Association (~1988-1992) // Cooking and restaurants // Hiking, running, biking, backpacking, exploring // Reading, incidental knowledge, anecdotal evidence.

REFERREED PUBLICATIONS:

1. "A Mechanistic Model of Eulerian, Lagrangian Mean, and Lagrangian Ozone Transport by Steady Planetary Waves," Rood, R. B., and Schoeberl, M. R., *J. Geophys. Res.*, 88, 5208-5218, 1983.
2. "Ozone Transport by Diabatic and Planetary Wave Circulations on a β -plane," Rood, R. B., and Schoeberl, M. R., *J. Geophys. Res.*, 88, 8491-8504, 1983.
3. "Transport and the Seasonal Variation of Ozone," Rood, R. B., *PAGEOPH*, 121, 1049-1064, 1983.
4. "Interpretation of Ozone Temperature Correlations: 1. Theory," Rood, R. B., and Douglass, A. R., *J. Geophys. Res.*, 90, 5733-5743, 1985.
5. "Interpretation of Ozone Temperature Correlations: 2. Analysis of SBUV Ozone Data," Douglass, A. R., Rood, R. B., and Stolarski, R. S., *J. Geophys. Res.*, 90, 10693-10708, 1985.
6. "A Critical Analysis of the Concept of Planetary Wave Breaking," Rood, R. B., *PAGEOPH*, 123, 733-755, 1985.
7. "The Derivation of Photochemical Information near 1 mbar from Ozone and Temperature Data," Douglass, A. R., and Rood, R. B., *J. Geophys. Res.*, 91, 13153-13166, 1986.
8. "Global Ozone Minima in the Historical Record," Rood, R. B., *Geophys. Res. Lett.*, 13, 1244-1247, 1986.
9. "Nitric Acid Forecast Experiments," Rood, R. B., Kaye, J. A., Nielsen, J. E., Schoeberl, M. R., and Geller, M. A., *Physica Scripta*, 36, 337-354, 1987.
10. "Numerical Advection Algorithms and their Role in Atmospheric Transport and Chemistry Models," Rood, R. B., *Rev. Geophys.*, 25, 71-100, 1987.
11. "Chemistry and Transport in a Three-Dimensional Stratospheric Model," Chlorine Species during a Simulated Stratospheric Warming," Kaye, J. A., and Rood, R. B., *J. Geophys. Res.*, 94, 1057-1083, 1989.
12. "The Use of Assimilated Stratospheric Data in Constituent Transport Calculations," Rood, R. B., Allen, D. J., Baker, W., Lamich, D., and Kaye, J. A., *J. Atmos. Sci.*, 46, 687-701, 1989.
13. "Three Dimensional Simulation of Spatial and Temporal Variability of Stratospheric Hydrogen Chloride," Kaye, J. A., Rood, R. B., Allen, D. J., Larson, E. J., and Jackman, C. H., *Geophys. Res. Lett.*, 16, 1149-1150, 1989.

14. "Wintertime Nitric Acid Chemistry: Implications from Three-Dimensional Model Calculations," Rood, R. B., Kaye, J. A., Douglass, A. R., Allen, D. J., Steenrod, S. D., and Larson, E. M., *J. Atmos. Sci.*, **47**, 2696-2709, 1990.
15. "Global Three-Dimensional Constituent Fields Derived from Profile Data," Douglass, A. R., Rood, R. B., Stolarski, R. S., Schoeberl, M. R., Proffitt, M. H., Margitan, J. J., Lowenstein, M., Podolske, J. R., and Strahan, S. E., *Geophys. Res. Lett.*, **17**, 525-528, 1990.
16. "The Effect of Solar Proton Events on the Middle Atmosphere during the Past Two Solar Cycles as Computed Using a Two-Dimensional Model," Jackman, C. H., Douglass, A. R., Rood, R. B., McPeters, R. D., and Meade, P. E., *J. Geophys. Res.*, **95**, 7417-7428, 1990.
17. "Three Dimensional Simulation of Hydrogen Chloride and Hydrogen Fluoride During the Airborne Arctic Stratosphere Expedition," Kaye, J. A., Douglass, A. R., Rood, R. B., Stolarski, R. S., Newman, P. A., Allen, D. J., Larson, E. M., Coffey, M. T., Mankin, W. G., and Toon, G. C., *Geophys. Res. Lett.*, **17**, 529-532, 1990.
18. "Stratospheric Temperatures During AASE: Results from STRATAN," Rood, R. B., Newman, P. A., Lait, L. R., Lamich, D. J., and Chan, R., *Geophys. Res. Lett.*, **17**, 337-340, 1990.
19. "The Influence of Polar Heterogeneous Processes on Reactive Chlorine at Middle Latitudes: Three-dimensional Model Implications", Douglass, A. R., Rood, R. B., Kaye, J. A., Stolarski, R. S., Allen, D. J., and Larson, E. M., *Geophys. Res. Lett.*, **18**, 25-28, 1991.
20. "Spatial and Temporal Variability of the Extent of Chemically Processed Stratospheric Air," Kaye, J. A., Douglass, A. R., Rood, R. B., Stolarski, R. S., Newman, P. A., Allen, D. J., and Larson, E. M., *Geophys. Res. Lett.*, **18**, 29-32, 1991.
21. "Three Dimensional Simulation of Wintertime Ozone Variability in the Lower Stratosphere," Rood, R. B., Douglass, A. R., Kaye, J. A., Geller, M. A., Chi, Y., Allen, D. J., Larson, E. M., Nash, E. R., and Nielsen, J. E., *J. Geophys. Res.*, **96**, 5055-5072, 1991.
22. "Application of a Monotonic Upstream Transport Scheme to Three Dimensional Constituent Transport Calculations," Allen, D. J., Douglass, A. R., Rood, R. B., and Guthrie, P. D., *Mon. Wea. Rev.*, **119**, 2456-2464, 1991.
23. "The Minor Stratospheric Warming of January 1989: Results from STRATAN, a Stratospheric/Tropospheric Data Assimilation System," Steenrod, S. D., Rood, R. B., Lamich, D. J., Rosenfield, J. E., and Govindaraju, R. C., *Mon. Wea. Rev.*, **120**, 221-229, 1992.

24. "Episodic Total Ozone Minima and Associated Effects on Heterogeneous Chemistry and Lower Stratospheric Transport," Rood, R. B., Nielsen, J. E., Stolarski, R. S., Douglass, A. R., Kaye, J. A., and Allen, D. J., *J. Geophys. Res.*, **97**, 7979-7996, 1992.
25. "Tracer Exchange between Tropics and Middle Latitudes," Rood, R. B., Douglass, A. R., and Weaver, C. J., *Geophys. Res. Lett.*, **19**, 805-808, 1992.
26. "Characteristics of Wintertime and Autumn Nitric Acid Chemistry as Defined by LIMS Data," Rood, R. B., Douglass, A. R., Kaye, J. A., and Considine, D. B., *J. Geophys. Res.*, **98**, 18533-18545, 1993.
27. "Thermodynamic Balance of Three Dimensional Stratospheric Winds Derived from a Data Assimilation Procedure," Weaver, C. J., Douglass, A. R., and Rood, R. B., *J. Atmos. Sci.*, **50**, 2987-2993, 1993.
28. "Implications of 3D Tracer Studies for 2D Assessments of the Impact of Supersonic Aircraft on Stratospheric Ozone," Douglass, A. R., Rood, R. B., Weaver, C. J., Cerniglia, M., and Brueske, K., *J. Geophys. Res.*, **98**, 8949-8963, 1993.
29. "The Effects of the October 1989 Solar Proton Events on the Stratosphere as Computed Using a Three-Dimensional Model," Jackman, C. H., Nielsen, J. E., Allen, D. J., Cerniglia, M. C., McPeters, R. D., Douglass, A. R., and Rood, R. B., *Geophys. Res. Lett.*, **20**, 459-462, 1993.
30. "A 3D Simulation of the Early Winter Distribution of Reactive Chlorine in the North Polar Vortex," Douglass, A. R., Rood, R. B., Waters, J., Froidevaux, L., Read, W., Elson, L., Geller, M., Chi, Y., Cerniglia, M., and Steenrod, S., *Geophys. Res. Lett.*, **20**, 1271-1274, 1993.
31. "An Assimilated Data Set for Earth Science Applications," Schubert, S. D., Rood, R. B., and Pfaendtner, J., *Bull Amer. Meteor. Soc.*, **74**, 2331-2342, 1993.
32. "A Comparison of Winds from the STRATAN Data Assimilation System to Geostrophic and Balanced Wind Estimates," Coy, L., Rood, R. B., and Newman, P. A., *J. Atmos. Sci.*, **51**, 2309-2315, 1994.
33. "Tracer Evolution in Winds Generated by a Global Spectral Mechanistic Model," Nielsen, J. E., Rood, R. B., Douglass, A. R., Cerniglia, M. C., Allen, D. J., and Rosenfield, J. E., *J. Geophys. Res.*, **99**, 5399-5420, 1994.
34. "Tracer Transport for Realistic Aircraft Emission Scenarios Calculated Using a Three-Dimensional Model," Weaver, C. J., Douglass, A. R., and Rood, R. B., *J. Geophys. Res.*, **100**, 5203-5214, 1995.

35. "A 3D Simulation on the Influence of a Cut-Off Low on the Distribution of Northern Hemispheric Processed Air in Late January, 1992," Cerniglia, M. C., Rood, R. B., and Douglass, A. R., *J. Geophys. Res.*, **100**, 11,641-11,660, 1995.
36. "Vertical Transport by Convective Clouds: Comparisons between Cloud-Scale and Global-Scale Models," Pickering, K. E., Thompson, A. M., Tao, W.-K., Rood, R. B., McNamara, D. P., and Molod, A. M., *Geophys. Res. Lett.*, **22**, 1089-1092, 1995.
37. "Stratosphere-Troposphere Exchange," Holton, J. R., Haynes, P. H., McIntyre, M. E., Douglass, A. R., Rood, R. B., and Pfister, L., *Rev. Geophys.*, **33**, 403-439, 1995.
38. "2D and 3D Model Simulations, Measurements, and Interpretation of the Influence of the October 1989 Solar Proton Events on the Middle Atmosphere," Jackman, C. H., Cerniglia, M. C., Nielsen, J. E., Allen, D. J., Zawodny, J. M., McPeters, R. D., Douglass, A. R., Rosenfield, J. E., and Rood, R. B., *J. Geophys. Res.*, **100**, 11,641-11,660; 1995.
39. "Upper-Tropospheric Water Vapor from UARS MLS," Read, W. G., Waters, J. W., Flower, D. A., Froidevaux, L., Jarnot, R. F., Hartmann, D. L., Harwood, R. S., and Rood, R. B., *Bull. American Met. Soc.*, **76**, 2381-2389, 1995.
40. "A Three Dimensional Simulation of the Ozone Annual Cycle Using Winds from a Data Assimilation System," Douglass, A. R., Weaver, C. J., Rood, R. B., and Coy, L., *J. Geophys. Res.*, **101**, 1463-1474, 1996.
41. "Three-dimensional Radon 222 Calculations Using Assimilated Meteorological Data and Convective Mixing Algorithm," Allen, D. J., Rood, R. B., Thompson, A. M., and Hudson, R. D., *J. Geophys. Res.*, **101**, 6871-6881, 1996.
42. "Transport-Induced Interannual Variability of Carbon Monoxide Determined Using a Chemistry and Transport Model," Allen, D. J., Kasibhatla, P., Thompson, A. M., Rood, R. B., Doddridge, B. G., Pickering, K. E., Hudson, R. D., and Lin, S.-J., *J. Geophys. Res.*, **101**, 28,655 - 28,669, 1996.
43. "Multidimensional Flux-Form Semi-Lagrangian Transport Schemes," Lin, S.-J., and Rood, R. B., *Mon. Wea. Rev.*, **124**, 2046-2070, 1996.
44. "Measurements of Polar Vortex Air in the Midlatitudes," Newman, P. A., Lait, L. R., Schoeberl, M. R., Seabloom, M., Coy, L., Rood, R. B., Swinbank, R., Proffitt, M., Lowenstein, M., Podolske, J.R., Elkins, J. W., Webster, C. R., May, R. D., Fahey, D. W., Dutton, G. S., and Chan, K. R., *J. Geophys. Res.*, **101**, 12, 879 - 891, 1996.
45. "An Explicit Flux-Form Semi-Lagrangian Shallow Water Model on the Sphere," Lin, S.-J., and Rood, R. B., *Quart. J. Royal. Met. Soc.*, **123**, 2477-2498 Part B, 1997.

46. “The Impact of Diabatic Initialization on Stratospheric Analyses, Forecasts, and Transport Experiments,” Fox-Rabinovitz, M. S., Rood, R. B., Lamich, D. J., Govindaraju, R. C., Coy, L., and Weaver, C. J., *Quart. J. Royal Met. Soc.*, **124**, 297-315 Part A, 1998.
47. “Impact of a Semi-Lagrangian and an Eulerian Dynamical Core on Climate Simulations,” Chen, M., Rood, R. B., and Takacs, L. L., *J. Climate*, **10**, 2374-2389, 1997.
48. “Synoptic-Scale Mass Exchange from the Troposphere to the Stratosphere,” Rood, R. B., Douglass, A. R., Cerniglia, M. C., and Read, W. G., *J. Geophys. Res.*, **102**, 23467-23485, 1997.
49. “Processes Controlling Dimethylsulfide Over the Ocean: Case Studies Using a 3-D Model Driven by Assimilated Meteorological Fields,” Chin, M., Rood, R. B., Allen, D. J., Andreae, M. O., Thompson, A. M., Lin, S.-J., Atlas, R., M., and Ardizzone, J. V., *J. Geophys. Res.*, **103**, 8341-8353, 1998.
50. “A Three-Dimensional Simulation of the Evolution of the Middle Latitude Winter Ozone in the Middle Stratosphere,” Douglass, A. R., Rood, R. B., Kawa, S. R., and Allen, D. J., *J. Geophys. Res.*, **102**, 19217-19232, 1997.
51. “A Study on Assimilating Potential Vorticity Data,” Li, Y., Menard, R., Riishojgaard, L. P., Cohn, S. E., and Rood, R. B., *Tellus A*, **50A**, 490-506, 1998.
52. “Upper Tropospheric Water Vapor from GEOS Reanalysis and UARS MLS Observation,” Chen, M., Rood, R. B., and Read, W. G., *J. Geophys. Res.*, **103**, 19587-19594, 1998.
53. “Seasonal Variations of Upper Tropospheric Water Vapor and High Clouds Observed from Satellites,” Chen, M., Rood, R. B., and Read, W. G., *J. Geophys. Res.*, **104**, 6193-6197, 1999.
54. “Assimilating TOVS Humidity into the GEOS-2 Data Assimilation System,” Chen, M., Rood, R. B., and Joiner, J., *J. Climate*, **12**, 2983-2995, 1999.
55. “Lamination Frequencies as a Diagnostic for Horizontal Mixing in a 3D Transport Model,” Weaver, C. J., Douglass, A. R., and Rood, R. B., *J. Atmos. Sci.*, **57**, 247-261, 2000.
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