

31 March 2003

VITA
Philip J. Rasch

DATE AND PLACE OF BIRTH: 31 December 1951
Ann Arbor, Michigan

EDUCATION:

B.A. Chemistry	1976	University of Washington
B.S. Atmospheric Science	1976	University of Washington
M.S. Meteorology	1979	Florida State University
Ph.D. Meteorology	1984	Florida State University

RESEARCH POSITIONS:

2001–present	Adjunct Faculty, University of Colorado, Boulder, Colorado
2000–present	Senior Scientist, National Center for Atmospheric Research, Boulder, Colorado.
1991–2000	Scientist III, National Center for Atmospheric Research, Boulder, Colorado.
Sep 1990–May 1991	Visiting Scientist, European Center for Medium-Range Weather Forecasts, Reading, England.
Apr 1990–Sep 1990	Visiting Scientist, Stockholm University, Stockholm, Sweden.
1987–1991	Scientist II, National Center for Atmospheric Research, Boulder, Colorado.
1984–1987	Scientist I, National Center for Atmospheric Research, Boulder, Colorado.
1983–1984	Postdoctoral Fellow, National Center for Atmospheric Research, Boulder, Colorado.
1981–1983	Graduate Research Assistant, National Center for Atmospheric Research, Boulder, Colorado.

PROFESSIONAL SOCIETIES AND COMMITTEES

American Meteorological Society, 1977–present.

American Association for the Advancement of Science, 1999–present.

AWARDS

1993: American Meteorological Society, Editors Award, Monthly Weather Review.

COMMITTEES AND PANELS:

Tellus Editorial Advisory Board, 1991–present.

Member, NSF Science and Technology Center for Clouds, Chemistry and Climate (C⁴)

Co-chair, Chemistry Modeling Group of C⁴

Steering Committee — International Global Atmospheric Chemistry group (IGAC) on Stratospheric and Upper Tropospheric Aerosols (SUTA)

Science Team — NASA project on establishing a Global Aerosol Climatology (GACP)

PUBLICATIONS

Rasch, P. J., 1985: Developments in normal mode initialization. Part I: A simple interpretation for normal mode initialization. *Mon. Wea. Rev.*, **113**, 1746–1753.

Rasch, P. J., 1985: Developments in normal mode initialization. Part II: A new method and its comparison with currently used schemes. *Mon. Wea. Rev.*, **113**, 1753–1770.

Rasch, P. J., 1986: Toward atmospheres without tops: Absorbing upper boundary conditions for numerical models. *Quart. J. Roy. Meteor. Soc.*, **112**, 1195–1218.

Errico, R. M., and P. J. Rasch, 1988: A comparison of various normal-mode initialization schemes and the inclusion of diabatic processes. *Tellus*, **40A**, 1–25.

Williamson, D. L., and P. J. Rasch, 1989: Two-dimensional semi-Lagrangian transport with shape preserving interpolation. *Mon. Wea. Rev.*, **117**, 102–129.

Donner, L. J. and P. J. Rasch, 1989: Cumulus initialization in a global model for numerical weather prediction. *Mon. Wea. Rev.*, **117**, 2654–2671.

Rasch, P. J., and D. L. Williamson, 1990a: On shape-preserving interpolation and semi-Lagrangian transport. *SIAM J. Sci. Stat. Comput.*, **11**, 656–687.

Rasch, P. J., and D. L. Williamson, 1990b: Computational aspects of moisture transport in global models of the atmosphere. *Quart. J. Roy. Meteor. Soc.*, **116**, 1071–1090.

Smolarkiewicz, P. and P. J. Rasch, 1991: Monotone advection on the sphere: An Eulerian versus semi-Lagrangian approach. *J. Atmos. Sci.*, **48**, 793–810.

Rasch, P. J., and D. L. Williamson, 1991: The sensitivity of a general circulation model climate to the moisture transport formulation. *J. Geophys. Res.*, **96**, 13,123–13,137.

Hess, P. G., D. S. Battisti and P. J. Rasch, 1993: Maintenance of the Intertropical Convergence Zone on a water covered earth. *J. Atmos. Sci.*, **V50**, 5, 691–713.

Williamson, D. L. and P. J. Rasch 1993: Water Vapor Transport in the NCAR CCM2, *Tellus*, **46A**, 34–51.

- Rasch, P. J., X.X. Tie, B. A. Boville, and D. L. Williamson, 1994: A Three Dimensional Transport Model for the stratosphere., *J. Geophys. Res.*, 99, 999-1018.
- Rasch, P. J., 1994: Conservative monotonic 2-dimensional transport on a spherical reduced grid, *Mon. Wea. Rev.*, 122, 6, 1337–1350.
- Hack, J. J. B.A. Boville, B. P. Briegleb, J. T. Kiehl, P. J. Rasch, and D. L. Williamson, 1994: Climate statistics from the National Center for Atmospheric Research Community Climate Model CCM2. *J. Geophys. Res.*, 99, 20785-20813
- Hartley, D., D.L. Williamson, Rasch, P. J. and R. Prinn, 1994: Examination of Tracer Transport in the NCAR CCM2 by Comparison of CFCL₃ Simulations with ALE/GAGE Observations, *J. Geophys. Res.*, 99, 12885-12896.
- Tie, X. X. , G. P. Brasseur, P. Friedlingstein, C. Granier, P. J. Rasch, 1994: The impact of high altitude aircraft on the ozone layer in the stratosphere, *J. Atmos. Chem.*, 18, 103–128.
- Ko M., A. Ibrahim, I. Siaksen, C. Jackman, F. Lefevre, M. Prather, P. Rasch, R. Toumi, and G. Visconti, 1995: Model Simulations of Stratospheric Ozone, in *Scientific Assessment of Ozone Depletion: 1994*, World Meteorological Organization, Global Ozone Research and Monitoring Project–Report No. 37.
- Rasch, P.J., B. A. Boville, and G. P. Brasseur, 1995: A Three-Dimensional General Circulation Model with Coupled Chemistry for the Middle Atmosphere, *J. Geophys. Res.*, 100, 9041-9071.
- Mahowald, N. M., P. J. Rasch, and R. G. Prinn, 1995: Cumulus Parameterizations in Chemical Transport Models, *J. Geophys. Res.*, 100, 26173–26189.
- Hecht, M.W., W.R. Holland and P.J. Rasch, 1995: Upwind-weighted advection schemes for ocean tracer transport: an evaluation in a passive tracer context. *J. Geophys. Res.*, 100, 20763-20778.
- H.-F. Graf, S. Cox, X.-Z. Liang, H. Mao, G. Myhre, P. Rasch, L. P. Riishøjgaard, K. Shine, I. Thorstensen, G.-X. Wu, I. Yagai, L. Zetterberg, 1995: Climate Modeling, in *Atmospheric Ozone as a Climate Gas*, W.-C. Wang and I. S. A. Isaksen, Eds., Springer, Germany, pp. 39-45.
- Erickson, D.J. III, P. J. Rasch, P. P. Tans, P. Friedlingstein, P. Ciais, E. Maier-Reimer, K. Six, C. A. Fischer, and S. Walters, 1996: The seasonal cycle of atmospheric CO₂: A study based on the NCAR Community Climate Model (CCM2). *J. Geophys. Res.*, 101, 15079-15097
- Jacob, D. J., M. J. Prather, B. A. Boville, P. J. Rasch, J. Feichter, P. S. Kasibhatla, Verver, J. E. Penner, D. Bergmann, C. Genthon, Y. J. Balkanski, P. Zimmermann, S. R. Beagley, W. T. Blackshear, D. A. Rotman, M. Chiba, M. Chipperfield, P. D.

- Brown, R.-L. Shia, K. Law, C. Reeves, M. Brown, 1997: Intercomparison of convective and synoptic transport in global models using ^{222}Rn and other tracers. *J. Geophys. Res.*, 102, 5953-5970.
- Brasseur, G. P., X. X. Tie, P. J. Rasch, and F. Lefèvre 1997: A three dimensional simulation of the Antarctic ozone hole: impact of anthropogenic chlorine on the lower stratosphere and upper troposphere. *J. Geophys. Res.*, 102, 8909-8930.
- Mahowald, P. J. Rasch, B. E. Eaton, S. Whittlestone and R. G. Prinn, 1997: Transport of $^{222}\text{radon}$ to the remote troposphere using the Model of Atmospheric Transport and Chemistry and assimilated winds from ECMWF and the National Center for Environmental Prediction/NCAR. *J. Geophys. Res.*, 102, 28139-28151.
- Rasch, P. J., N. M. Mahowald and B. E. Eaton, 1997: Representations of transport, convection and the hydrologic cycle in chemical transport models: Implications for the modeling of short lived and soluble species. *J. Geophys. Res.*, 102, 28127-28138.
- Mahowald, N. M., R. G. Prinn and P. J. Rasch, 1997: Deducing CCl_3F emissions using an inverse method and chemical transport models with assimilated winds, *J. Geophys. Res.*, 103, 28153-28168.
- Waugh, D.W., T.M. Hall, W.J. Randel, P.J. Rasch, B.A. Boville, K.A. Boering, S.C. Wofsy, D.C. Daube, J.W. Elkins, E.W. Fahey, G.S. Dutton, C.M. Volk, and P.F. Vohralik, 1997: Three dimensional simulations of long-lived tracers using winds from MACCM2, *J. Geophys. Res.*, 102, 21493-21513.
- Kiehl, J.T., J.J. Hack, G.B. Bonan, B.B. Boville, D.L. Williamson, and P.J. Rasch, 1997: The National Center for Atmospheric Research Community Climate Model: CCM3. *J. Climate*, 11, 1131-1149.
- Krishnamurti, T.N., B. Jha, P.J. Rasch, and V. Ramanathan, 1997: A high resolution global reanalysis highlighting the winter monsoon. Part I, reanalysis fields. *Meteor. Atmos. Phys.*, 64, 123-150.
- Krishnamurti, T.N., B. Jha, P.J. Rasch, and V. Ramanathan, 1997: A high resolution global reanalysis highlighting the winter monsoon. Part II: Transients and passive tracer transports. *Meteor. Atmos. Phys.*, 64, 151-171.
- Rasch, P.J., and J.E. Kristjánsson, 1998: A comparison of the CCM3 model climate using diagnosed and predicted condensate parameterizations. *J. Climate*, 11, 1587-1614.
- Zhang, G. J., J. T. Kiehl and P. J. Rasch, 1998: Response of climate simulation to a new convective parameterization in the National Center for Atmospheric Research Community Climate Model (CCM3), *J. Climate*, 11, 8, 2097-2115.

- Craig, S.G., K. J. Holmén, G. B. Bonan, and P. J. Rasch, 1998: Atmospheric CO₂ simulated by the NCAR Community Climate Model: I. Mean fields and seasonal cycles. *J. Geophys. Res.*, 103, 13213-13235.
- G.P. Brasseur, D.A. Hauglustaine, W. Walters, P.J. Rasch, J.-F. Müller, C. Granier, and X.X. Tie, 1998: MOZART: A global chemical transport model for ozone and related chemical tracers, part 1: Model description. *J. Geophys. Res.*, 103, 28265-28289.
- D.A. Hauglustaine, G.P. Brasseur, S. Walters, P.J. Rasch, J.-F. Müller, L.K. Emmons, and M.A. Carroll, 1998: MOZART: A global chemical transport model for ozone and related chemical tracers, part 2: Model results and evaluation. *J. Geophys. Res.*, 103, 28291-28335.
- Lawrence, M.G., P.J. Crutzen, and P.J. Rasch, 1999: Analysis of the CEPEX ozone data using a 3D chemistry-meteorology model. *Quart. J. Roy. Meteor. Soc.*, 125, 2987–3009.
- Lawrence, M.J, P. J. Crutzen, P. J. Rasch, B. E. Eaton, and N. M. Mahowald, 1999: A model for studies of tropospheric photochemistry: 1. Description and Global simulation Characteristics. *J. Geophys. Res.*, 104, 26245–26277s.
- Douglass, A. R., M. P. Prather, T. Hall, S. E. Strahan, P. Rasch, L. Sparling, L. Coy, and J. Rodriguez: 1999, Choosing meteorological input for the global modeling initiative assessment of high speed aircraft., *J. Geophys. Res.*, 104, 27545–27564.
- Barth, M., P. J. Rasch, J. T. Kiehl, C. M. Benkovitz and S. E. Schwartz, 2000: Sulfur chemistry in the NCAR CCM: Description, evaluation, features and sensitivity to aqueous chemistry. *J. Geophys. Res.*, 105, 1387–1415.
- Rasch, P. J, M. Barth, J. T. Kiehl, C.M. Benkovitz, and S.E. Schwartz, 2000: A description of the global sulfur cycle and its controlling processes in the NCAR CCM3. *J. Geophys. Res.*, 105, 1367–1385.
- Kiehl, J. T. T. L. Schneider, P. J. Rasch, M. Barth and J. Wong, 2000: Radiative Forcing due to Sulfate aerosols from simulations with the NCAR Community Climate Model (CCM3), *J. Geophys. Res.*, 105, 1441–1457.
- Rasch, P.J., J. Feichter, K. Law, N. Mahowald and J. Penner, et. al., 2000: A comparison of scavenging and deposition processes in global models: Results from the WCRP Cambridge workshop of 1995. *Tellus*, 52, 1025–1056.
- Rotman, D. A., J. R. Tannahill, D. E. Kinnison, P. S. Connell, D. Bergmann, D. Proctor, J. M. Rodriguez, S. J. Lin, R. B. Rood, M. J. Prather, P. J. Rasch, D. B. Considine, R. Ramarosan, and S. R. Kawa, 2001: Global Modeling Initiative assessment model: Model description, integration, and testing of the transport shell. *J. Geophys. Res.*, 106, 1669–1691.

- Jöckel, P., R. von Kuhlmann, M. G. Lawrence, B. Steil, C. A. M. Brenninkmeijer, P. J. Crutzen, P. J. Rasch, and B. Eaton, 2001: On a fundamental problem in implementing flux-form advection schemes for tracer transport in 3-dimensional general circulation and chemistry transport models. *Quart. J. Roy. Meteor. Soc.*, 127, 1035–1052.
- Collins, W. D., P. J. Rasch, B. E. Eaton, B. Khattatov, J-F. Lamarque and C. S. Zender, 2001: Simulating aerosols using a Chemical Transport Model with assimilation of satellite aerosol retrievals: Methodology for INDOEX, *J. Geophys. Res.*, 106, 7313–7336.
- Barrie, L. A., Y. Yi, W. R. Leitch, U. Lohmann, P. Kasibhatla, G.-J. Roelofs, J. Wilson, F. McGovern, C. Benkovitz, M.A. Mélières, K. Law, J. Prospero, M. Kritz, D. Bergmann, C. Bridgeman, M. Chin, J. Christensen, R. Easter, J. Feichter, C. Land, A. Jeuken, E. Kjellström, D. Koch, and P. Rasch, 2001: A comparison of large-scale atmospheric sulphate aerosol models (COSAM): Overview and highlights. *Tellus*, 53, 615–645
- Kinnison, D. E., P. S. Connell, J. M. Rodriguez, D. A. Rotman, D. B. Considine, J. Tannahill, R. Ramarosan, P. J. Rasch, A. R. Douglas, S. L. Baughcum, L. Coy, D. W. Waugh, S. R. Kawa, and M. J. Prather, 2001: The global modeling initiative assessment model: Application to high-speed civil transport perturbation. *J. Geophys. Res.*, 106, 1693–1711.
- Lohmann, U., W. R. Leitch, L. Barrie, K. Law, Y. Yi, D. Bergmann, C. Bridgeman, M. Chin, J. Christensen, R. Easter, J. Feichter, A. Jeuken, E. Kjellström, D. Koch, C. Land, P. Rasch and G.-J. Roelofs, 2001: Vertical distributions of sulfur species simulated by large scale atmospheric models in COSAM: Comparison with observations, *Tellus*, 53, 646–672.
- Roelofs, G.-J., P. Kasibhatla, L. Barrie, D. Bergmann, C. Bridgeman, M. Chin, J. Christensen, R. Easter, J. Feichter, A. Jeuken, E. Kjellström, D. Koch, C. Land, and P. Rasch, 2001: Analysis of regional budgets of sulfur species modeled for the COSAM exercise. *Tellus*, 53, 673–694.
- Ramanathan, V., P.J. Crutzen, J. Lelieveld, D. Althausen, J. Anderson, M.O. Andreae, W. Cantrell, G. Cass, C.E. Chung, A.D. Clarke, W.D. Collins, J.A. Coakley, F. Dulac, J. Heintzenberg, A.J. Heymsfield, B. Holben, J. Hudson, A. Jayaraman, J.T. Kiehl, T.N. Krishnamurti, D. Lubin, A. P. Mitra, G. MacFarquhar, T. Novakob, J.A. Ogren, I.A. Podgorny, K. Prather, J.M. Prospero, K. Priestley, P.K. Quinn, K. Rajeeb, P. Rasch, S. Rupert, R. Sadourny, S.K. Satheesh, P. Sheridan, G.E. Shaw, and F.P.J. Valero, 2000: The Indian Ocean Experiment: An integrated assessment of the climate forcing and effects of the great Indo-Asian haze. *J. Geophys. Res.*, 106, 28371–28398.
- Boville, B. A., J. T. Kiehl, P. J. Rasch, and F. O. Bryan, 2001: Improvements to the NCAR CSM-1 for transient climate simulations. *J. Climate*, 14, 164–179.

- Rasch, P. J., W. D. Collins, and B. E. Eaton, 2001: Understanding the Indian Ocean Experiment (INDOEX) aerosol distributions with an aerosol assimilation. *J. Geophys. Res.*, 106, 7337–7355.
- Clark, A. W. Collins, P. Rasch, V. Kapustin, K. Moore, and S. Howell, 2001: Dust and pollution transport on global scales: Aerosol measurements and model predictions, *J. Geophys. Res.*, 106, 32555–32570.
- Bergman, J.W., and P.J. Rasch, 2002: Parameterizing vertically-coherent cloud distributions. *J. Atmos. Sci.*, 14, 2165–2182.
- Collins, W.D., P.J. Rasch, B.E. Eaton, D.W. Fillmore, J.T. Kiehl, C.T. Beck, C.S. Zender, 2002: Simulation of aerosol distributions and radiative forcing for INDOEX: Regional climate impacts. *J. Geophys. Res.*, in press.
- Colarco, P.R., O.B. Toon, O. Torres, and P.J. Rasch, 2002: Determining the UV imaginary index of refraction of Saharan dust particles from TOMS data and a three dimensional model of dust transport. *J. Geophys. Res.*, in press.

TECHNICAL REPORTS

- Rasch, P. J., J. T. Kiehl, and W. T. Wyman, 1983: *Translation of “The Mechanism of Meteorological Noise” by K. Hinkelmann (1951, Tellus) from the German.* NCAR Technical Note TN-203+STR.
- Williamson, D. L., and P. J. Rasch, 1988: Shape preserving interpolators for semi-Lagrangian transport, *Proc. Workshop ECMWF on Techniques for Horizontal Discretization in Numerical Weather Prediction Models*, 2–4 November 1987, European Centre for Medium-Range Weather Forecasts, Reading, England, pp. 117–142.
- Rasch, P. J., and D. L. Williamson, 1988: Shape preserving interpolators for semi-Lagrangian transport. *Proc. AMS Conference on Numerical Weather Prediction*, February 1988, Baltimore, Md. 515–522.
- Williamson, D. L., and P. J. Rasch, 1988: Semi-Lagrangian moisture transport in global spectral models. *Proc. AMS Conference on Numerical Weather Prediction*, February 1988, Baltimore, Md., 523–530.
- Rasch, P. J. and D. L. Williamson, 1989: A comparison of shape preserving interpolators, NCAR Tech. Note, NCAR/TN-339+STR, National Center for Atmospheric Research, Boulder, Colo., NTIS PB89-226336/AS, 60 pp.
- Rasch, P. J. and D. L. Williamson, 1991: The sensitivity of a general circulation model climate to moisture transport. *Proc. ECMWF/WCRP Workshop on Clouds, Radiative Transfer and the Hydrological Cycle*, Reading, 1990, 413–450.

- Williamson, D., P. Rasch and D. Hartley, 1996: Results of CFC-11 experiment: The NCAR CCM2. *Proc. WCRP Symposium on Global Tracer Transport Models*, Bermuda, 1990, WMO/TD-No. 770, 77–95.
- Morcrette, J.-J., L. Illari, E. Klinker, H. LeTreut, M. Miller, P. Rasch, and M. Tiedtke, 1991: Clouds and radiation. Research Department, Technical Memorandum No. 181, European Centre for Medium-Range Weather Forecasts, Reading, England.
- Hack, J. J. B.A. Boville, B. P. Briegleb, J. T. Kiehl, P. J. Rasch, and D. L. Williamson, 1993: Description of the NCAR Community Climate Model (CCM2). NCAR Tech. Note NCAR/TN-382+STR, 108pp.
- Rasch, P. J., B. Eaton, N. Mahowald and B. Boville, 222 Radon and 210 lead Simulations with the NCAR CCM2., in *Proceedings of the WCRP Symposium on the role of subgridscale processes on short lived tracers*, Virginia Beach, 1993a.
- Rasch, P. J., H. Feichter, K. Law, and J. Penner, 1995b: Report to the World Meteorological Organization; Modelling of trace constituents by Global Models.
- Rasch, P. J. and M. G. Lawrence, 1998: Recent developments in transport methods at NCAR, in *Proceedings of the MPI workshop on conservative transport methods.*, Report No. 265., edited by Bennert Machenhauer, 93pp, Max Planck Institute for Meteorology, Hamburg, Germany.