

## CURRICULUM VITAE

**Peter B. Rhines**, Professor of Oceanography and Atmospheric Sciences,  
University of Washington, Seattle, Washington USA

**Born:** 23 July 1942

**Citizenship:** US

### Education

- 1967 Trinity College, Cambridge University, England, Ph.D.  
Dissertation: Slow oscillations in an ocean of varying depth
- 1964 Massachusetts Institute of Technology, M.S., B.S.  
in Aeronautics and Astronautics. Dissertation: Boundary-layer  
oscillations over a resonant wall

### Scholastic Achievements

- 1964-67 Marshall Scholar, Trinity College, Cambridge
- 1963-64 National Science Foundation Graduate Fellow, MIT
- 1960-63 Sloan Scholar, MIT
- 1960 First Scholar, Loomis School class of 1960.

### Honors and Awards

- 2008 appointed as Founding Member, Washington State Academy of Sciences
- 2005 Gledden Fellow, University of Western Australia
- 2005 Bernard Haurwitz Award Lecturer, American Meteorological Society (lectures  
at San Diego and Boston AMS meetings)
- 2005 appointed Houghton Lecturer, MIT
- 1999 elected Fellow of American Academy of Arts and Sciences  
'for elegant theoretical studies that have initiated new fields of inquiry,  
and a grasp of physical mechanisms in oceanic dynamics that is  
unparalleled'
- 1999 NOAA/CIRES Distinguished Visiting Lecturer, University of Colorado
- 1999 Henry Stommel Research Award, American Meteorological Society  
'for amazing physical insight and profound appreciation of observations  
as a guide to understanding how the ocean works'
- 1998, 2004 Distinguished Visiting Professor, Scripps Inst. of Oceanography
- 1996 Creativity Award, National Science Foundation (a \$450K grant)
- 1996 Ogura Lecturer, Dept. of Atmospheric Sciences, Univ. of Illinois
- 1995, 2004 Steinbach Visiting Scholar, Woods Hole Oceanographic Institution
- 1993 elected Fellow of the American Meteorological Society
- 1989 Ocean Sciences Educator Award, Office of Naval Research
- 1988 elected Fellow of the American Geophysical Union
- 1988 Senior Queen's Fellow in Marine Sciences, Australia
- 1981 elected to National Academy of Sciences  
'the father of a school of theoretical oceanography that has spawned  
many advances in the statistical mechanics of ocean currents.'
- 1981 Green Scholar, Institute for Geophysics and Planetary

- Planetary Physics, University of California, San Diego
- 1980 Outstanding Publication Award, National Center for  
Atmospheric Research (with W.R.Holland)
- 1979-80 Guggenheim Fellowship
- 1979-80 Distinguished Visiting Research Fellowship, Christ's College, Cambridge
- 1979 Medal of the University of Liege, Belgium
- 1963 Adm. Luis de Florez Research Award, MIT  
'for ingenuity and creativity in laboratory experiments'

Listed in International Who's Who, Who's Who in America

### **Professional Experience**

- 2008- Adjunct Professor, Aerospace Engineering Dept., University of Washington
- 1984- Professor of Oceanography and Atmospheric Sciences,  
University of Washington
- 1984- Senior Fellow, Joint Institute for Study of the Atmosphere and ocean,  
University of Washington
- 1974-84 Senior Scientist, Woods Hole Oceanographic Institution
- 1979-82 Director, Center for Analysis of Marine Systems  
(CAMS), Woods Hole Oceanographic Institution
- 1972-74 Associate Scientist, Woods Hole Oceanographic Institution
- 1971-72 Assistant in Research, Dept. of Applied Mathematics and  
Theoretical Physics, Cambridge University
- 1968-71 Assistant Professor, Dept. of Meteorology, Massachusetts  
Institute of Technology
- 1967-68 Research Associate, Massachusetts Institute of Technology

### **Visiting Positions**

- 2005 Visiting Prof., University of Reading Dept. of Meteorology;  
UW/Bergen Exchange Professor, University of Bergen, Norway  
Gleddon Fellow, University of Western Australia
- 1994 Visiting Scientist, Institut für Meereskunde, Kiel, Germany
- 1988,95 Visiting Scientist, Queen's Fellow, CSIRO Marine Laboratories, Australia
- 1983 Visiting Scientist, National Center for Atmospheric Research  
Senior Visiting Fellow, Natural Environmental Research Council, England
- 1981 Green Scholar, Institute for Geophysics  
and Planetary Physics, Univ. of California, San Diego
- 1979-80 Visiting scientist, Department of Applied Mathematics and  
Theoretical Physics, Cambridge University
- 1978 Visiting Senior Scientist in Geophysical Fluid Dynamics, Princeton University  
Visiting Lecturer, Geological and Planetary Science, California Inst. of Technology
- 1976 Visiting Professor, University of Colorado
- 1975 Visiting Lecturer, University of British Columbia
- 1969,72 Visiting Scientist, National Center for Atmospheric Research
- 1970 Visiting Scientist, Woods Hole Oceanographic Institution

### **Professional Service**

- 2007- BIAC (Bipolar Atlantic Circulation) project, University of Bergen, International Polar Year, Scientific Advisory Board
- 2008- POCAHONTAS project, University of Bergen, Scientific Advisory Board
- 2005- Bjercknes Climate Center, Bergen Norway, Science Advisory Board
- 2004-7 Climate Research Committee, National Research Council
- 2003-2005 SEARCH program Scientific Steering Committee
- 2001- ASOF (Arctic/SubArctic Ocean Flux): Scientific Steering Group co-chairman
- 2000-02 Panel on Abrupt Climate Change, National Research Council
- 1998-2001 NSF Decadal Planning Committee for Oceanography
- 1996-9 Committee to Review Results of ATOC's Marine Mammal Research Program, National Research Council
- 1998-9 The Ocean's Role in Human Health - National Research Council Panel
- 1997-8 APROPOS panel, National Science Foundation, steering committee.
- 1997-8 Atlantic Climate Variability Experiment planning group
- 1995 GOOS Panel, National Research Council
- 1994-6 GOALS planning group, National Research Council
- 1994-97 Ocean Studies Board, National Research Council
- 1992 External review committee, School of Ocean and Earth Sciences and Technology, University of Hawaii
- 1990-91 NSF Panel Member, Physical Oceanography
- 1990 UCAR Review Panel, CGS Division of NCAR
- 1989-93 UCAR postdoctoral selection committee for ocean modelling (chairman)
- 1985-88,1991 National Academy of Sciences: Agassiz Committee (chairman 1991)
- 1983-88 Editorial Board, Annual Reviews of Fluid Mechanics
- 1982-83 National Research Council, Survey committee on plasma- and fluid physics
- 1978-79 Committee on Oceanography, American Meteorological Society  
U.S. Committee for the Global Atmospheric Research Program
- 1978-92 Steering Committee, Geophysical Fluid Dynamics Program,  
Woods Hole Oceanographic Institution
- 1977-86 Associate Editor, Journal of Physical Oceanography
- 1976-84 Editorial Board, Geophysical and Astrophysical Fluid Dynamics  
Members' Representative, University Corporation for  
Atmospheric Research
- 1975-78 Steering Committee on Small-Scale Analysis and Prediction,  
National Center for Atmospheric Research (chairman)  
Theoretical Panel (chairman), Mid-Ocean Dynamics Experiment
- 1974-2003 Editorial Board, Journal of Marine Research
- 1973-76 Committee on Waves and Stability, American Meteorological  
Society

### **University committees**

- 2004- Adjunct Faculty, UW Canadian Studies Center
- 2004- Advisory Board, UW Honors Program
- 2002-3 Faculty Council, School of Oceanography
- 2001-5 Recruitment Committee, School of Oceanography
- 2000-4 Steering Committee, Program on Climate Change
- 1993-5 Friday Harbor Laboratories Advisory Committee (Willows ch.)

- 1992-3 Committee on Global Change Research (Hartmann ch.)
- 1991-2 Committee on Interdisciplinary Research (Miles, ch.)
- 1984-87 Academic Computing Executive Committee (Woodruff ch.)
- 1984-88 Faculty Council, School of Oceanography

### Research Interests

Global climate change, the oceanic general circulation, waves and eddies  
 atmospheric dynamics, particularly in the subpolar oceans; motion of trace chemicals;  
 theoretical dynamics, laboratory experiments in oceanography and geophysical fluid  
 dynamics; computer models of ocean circulation; teaching global environmental  
 studies to undergraduates

### Undergraduate Courses

*University of Washington*

- 2008 Oceans and the global environment: taking physics and chemistry outdoors.  
 UW Discovery Seminar (a 5-credit course, Aug-Sept). *UW Honors* AS 221a
- 2004, 2006, 2007, 2009 Intro to Energy and Environment: Life Under the Pale  
 Sun, *UW Honors* AS 222
- 2002, 2003 Earth, Air, Water: the Human Context, *Envir202*, *Program on the Environment*
- 1998 Freshman Seminar, Tides, Twisters and Gyres, taking physics out of doors (with  
 P. MacCready; 2 credits)
- 1997 Freshman Seminar, Twisters, Hurricanes and Gyres: taking physics out of doors  
 1 credit)

### Graduate Lecture Courses

*School of Oceanography and Department of Atmospheric Sciences, University of Washington:*

- 1990,91,92,94,97,99,2000,2008 Laboratory Projects in Geophysical Fluid Dynamics  
 (a.k.a. Experimenting with Fluids) OC548a, OC569a
  - 2008 Jets: intense circulations in oceans and atmospheres, OC569c
  - 1985-89, 91-94, 2001, 2003, 2004 GFD-I (Geophysical fluid dynamics-I) AS 509/OC  
 512
  - 1992-2009 Laboratory demonstrations for GFD-1, Ocean 512/Atmos.Sci 509
  - 1986-87, 2003-4, 2006, 2007 GFD-II OC 510/513
  - 1989,90,98,99 Intro to Fluid Dynamics OC504/511; AS505
  - 2003-2008 Laboratory demonstrations for Intro to Fluid Dynamics, Ocean 511, AS 505
  - 1999 Potential vorticity dynamics of ocean/atmosphere circulations OC569b
  - 1997 Wave/mean-flow interaction in oceans and atmospheres, Ocean 569.
  - 1996-98 Waves in Oceans and Atmospheres, Ocean 514
  - 1996, 2001 Subpolar dynamics and climate change, Ocean 569a
  - 1988,92 Eddy- and Wave-Mean Flow Interaction OC548
  - 1986 Inverse methods, tracers and general circulation (with J.Willebrand)  
 OC 548a
  - 1986 Chemical tracers OC 522
  - 1985 Geophysical fluid dynamics of eddies and circulation AS/OC 548
- Friday Harbor Laboratories, University of Washington., Ocean 590b:*
- 1990 summer Biogeochemical cycles and oceanic circulation
  - 1993 " Decadal climate variability and ocean/atmosphere dynamics
  - 1999 " Coastal and estuarine geophysical fluid dynamics

*Woods Hole Oceanographic Institution/M.I.T. Joint Graduate Program:*

1972-84 Waves; Dynamics of Eddies and Circulation  
1982 Summer Geophysical Fluid Dynamics Program:  
co-principal lecturer

*M.I.T. Meteorology Dept:*

1968-71 Waves in Oceans and Atmospheres 19.86  
1968-71 Dynamic Oceanography 19.84

*California Inst. of Technology:*

1978 Geophysical fluid dynamics

*University of Colorado:*

1976 Planetary fluid dynamics

**Graduate students** (principal thesis advisor, 15 completed Ph.D. degrees, 3 M.Sc. degrees)

Caroline Harbitz	Ph.E. in progress (with S. Riser)
Nick Beard	Ph.D. in progress (with C.Eriksen)
Jonathan Wai	M.S. 2009 (Aerospace Eng.Dept., UW)
Eleanor Williams	Ph.D. 2009
Leif Thomas	Ph.D. 2003 University of Washington
Jerome Cuny	Ph.D 2003 University of Washington
Jonathan Lilly	Ph.D. 2002 University of Washington
Robert Hallberg	Ph.D. 1995 University of Washington
Matthew Trunnell	M.Sc. 1993 University of Washington
David Pierce	Ph.D 1993 University of Washington
Parker MacCready	Ph.D 1991 University of Washington
David Straub	Ph.D 1990 University of Washington
Laura Landrum	M.Sc. 1990 University of Washington
Albert Hermann	Ph.D. 1988 University of Washington (with Barbara Hickey)
Theodore Shepherd	Ph.D. 1984 MIT-Meteorology Department
William R. Young	Ph.D. 1981 WHOI/MIT Graduate Program
Alain Colin de Verdiere	Ph.D. 1977 WHOI/MIT Graduate Program
Kuh Kim	Ph.D. 1974 WHOI/MIT Graduate Program
Chi-Yuan Lee	Ph.D. 1971 WHOI/MIT Graduate Program
Alfredo E. Suarez	Ph.D. 1970 WHOI/MIT Graduate Program

**Postdoctoral investigators** (principal advisor, 17 post-docs)

Hjalmar Hatun	UW 2004-2006
Leif Thomas	UW 2004-2005
Jonathan Lilly	UW 2002-2003
Wei Cheng	UW 2000-2003
David Bailey	UW 2000-2004
Ralf Doescher	UW 1997-98
Andrew Stamp	UW 1994-95 (UCAR Fellow)
LuAnne Thompson	UW 1990-92 (COFS Fellow)
Dan Ohlsen	UW 1990-93 (ONR Education Award Fellow)
Scott Condie	UW 1990-92 (UCAR Fellow, with M. Kawase)
Richard Schopp	UW 1987-89
Lee Panetta	UW 1984-85
David Musgrave	WHOI 1981-83 (WHOI Fellow, with W. Jenkins)

Thomas Keffer	WHOI 1981-83 (WHOI Fellow)
John Loder	WHOI 1977-78 (WHOI Fellow)
Brechner Owens	WHOI 1975-77
Howard Freeland	WHOI 1973-75

### Graduate student advisees: international exchange students

Kristin Richter, WUN fellow, UW-University of Bergen, Norway exchange student 2008  
 Laure Grignon, WUN fellow, Univ. of Southampton, England, Sep-Dec 2007  
 Elin Darelius, UW-Bergen exchange student, Apr-Jun 2005, spring 2008  
 Elizabeth Hawker, WUN fellow, Southampton Oceanographic Centre, England Aug-Dec 2006; April-May 2008 (Elizabeth became the World Ultramarathon Champion in Seoul, Korea 2007)

### Undergraduate student advisees

Jonathan Wai	summers 2007-2009 student fellow, UW
Caitlin Whalen	summer 2007 student fellow, Reed College, OR
Alex Mendez	UW 2004-2007 NASA Space Grant Summer Fellow/year-round employee
David Peterson	UW 2000-2004 NASA Fellow and year-round student employee
Adam Van Etten	UW 2004 NASA Space Grant Summer Fellow
Race Roberson	UW 2002 NASA Space Grant Summer Fellow
Zong Li	UW 2001 NASA Space Grant Summer Fellow
Amit Mahtani	UW 2001 NASA Space Grant Summer Fellow
Brian Scansen	UW 1996-2000 NASA Fellow and year-round student employee
Paul Limont	UW 2000 NASA Space Grant Summer Fellow
Daryl Jackson	UW summer 2000
Kevin McHugh	UW 2000 Oceanog/Atmos Sci
Joshua Talley	UW 2000 Oceanography

### Publications

1. Rhines, P.B. and E.L. Mollo-Christensen, 1967, Boundary layer oscillations over a resonant surface, *Physics of Fluids* 10(5), 916-926.
2. Rhines, P.B., 1969, Slow oscillations in an ocean of varying depth; Part I. Abrupt topography, *J. Fluid Mech.* 37, 161-189.
3. Rhines, P.B., 1969, Slow oscillations in an ocean of varying depth; Part II. Island and seamounts, *J. Fluid Mech.* 37, 191-205.
4. Rhines, P.B., 1970, Wave propagation in a periodic medium with application to the ocean, *Rev. Geophys. Space Phys.* 8(2), 303-319.
5. Rhines, P.B., 1970, Edge-, bottom-, and Rossby waves in a rotating stratified fluid, *Geophys. Fluid Dyn.* 1, 273-302.
6. Rhines, P.B., 1971, A note on long-period motions at Side D, *Deep-Sea Res.* 18, 21-26.
7. Rhines, P.B., 1971, A comment on the Aries observations, *Phil. Trans. Roy. Soc. London*, A270, 461-463.
8. Rhines, P.B. and F. Bretherton, 1973, Topographic Rossby waves in a rough-bottomed ocean, *J. Fluid Mech.* 61, 583-607.

9. Pollard, R.T., P.B. Rhines and R.O.R.Y. Thompson, 1973, The deepening of the wind-mixed layer, *Geophys. Fluid Dyn.* 3, 381-404.
10. Rhines, P.B., 1973, Observations of the energy-containing oceanic eddies, and theoretical models of waves and turbulence. *Boundary-Layer Meteorology* 4, 345-360.
11. Rhines, P.B., 1975, Waves and turbulence on a beta-plane. *J. Fluid Mech.* 69, 417-443.
12. Freeland, H.F., P.B. Rhines and H.T. Rossby, 1975, Statistical observations of the trajectories of neutrally buoyant floats in the North Atlantic, *J. Mar. Res.* 33(3), 383-404
13. de Szoeke, R. and P.B. Rhines, 1976, Asymptotic regimes in mixed-layer deepening, *J. Mar. Res.* 34(1), 111-116.
14. Rhines, P.B., 1977. The dynamics of unsteady currents, *In: The Sea*, Vol. VI, E.D. Goldberg (ed.), John Wiley and Sons, Inc., NY, pp. 189-318.
15. The MODE Group, 1978, The Mid-Ocean Dynamics Experiment, *Deep-Sea Res.* 25(10), 859-910.
16. Rhines, P.B., 1979, Geostrophic turbulence, *Ann. Rev. Fluid Mech.* 11, 404-441.
17. Rhines, P.B. and W.R. Holland, 1979, A theoretical discussion of eddy-driven mean flows, *Dyn. Atmos. Ocean* 3, 289-325.
18. Young, W.R. and P.B. Rhines, 1980, Rossby wave action, enstrophy and energy in forced mean flows, *Geophys. Astrophys. Fluid Dyn.* 15(1+2), 39-52.
19. Holland, W.R. and P.B. Rhines, 1980, An example of eddy-induced ocean circulation, *J. Phys. Oceanogr.* 10(7), 1010-1031.
20. Jenkins, W.J. and P.B. Rhines, 1980, Tritium in the deep North Atlantic Ocean, *Nature* 286, 877-880.
21. Young, W.R., P.B. Rhines and C.J.R. Garrett, 1982, Shear-flow dispersion, internal waves and horizontal mixing in the ocean, *J. Phys. Oceanogr.* 12(6), 515-527.
22. Rhines, P.B. and W.R. Young, 1982, A theory of the wind-driven circulation; I. Mid-ocean gyres, *J. Mar. Res.* suppl. to 40(3), 559-596.
23. Young, W.R. and P.B. Rhines, 1982, A theory of the wind-driven circulation; II. Gyres with western boundary layers, *J. Mar. Res.* 40(3), 849-872.
24. Rhines, P.B. and W.R. Young, 1982, Homogenization of potential vorticity in planetary gyres, *J. Fluid Mech.* 122, 347-367.
25. McDowell, S., P.B. Rhines and T. Keffer, 1982, North Atlantic potential vorticity and its relation to the general circulation, *J. Phys. Oceanogr.* 12(12), 1417-1436
26. Rhines, P.B., 1983, Lectures in geophysical fluid dynamics, *in Fluid Mechanics in Astrophysics and Geophysics*, Vol. 20 of Studies in Applied Mathematics, Amer. Math. Soc., pp. 3-58.
27. Rhines, P.B. and W.R. Young, 1983, How quickly is a passive scalar mixed within closed streamlines? *J. Fluid Mech.* 133, 133-145.
28. Haidvogel, D. and P.B. Rhines, 1983, Waves and circulation driven by oscillatory winds in an idealized ocean basin, *Geophys. Astrophys.*

*Fluid Dyn.* 25, 1-65.

29. Dickson, R.R., P.B. Rhines and E. Brown, 1983, Vertical structure of the eddy field at midlatitudes, *In: Eddies in Marine Science*, A Robinson (ed.), Springer-Verlag, NY, pp. 324-327.
30. Brewer, P., W.S. Broecker, W.J. Jenkins, P.B. Rhines, C.G. Rooth, J.H. Swift, T. Takahashi and R.T. Williams, 1983, A climatic freshening of the deep North Atlantic over the past 20 years, *Science* 222, 1237-1239.
31. Rhines, P.B., T. Keffer and W.R. Holland, 1984, The general circulation of the oceans: the potential vorticity field, *Nature* 308, 698-705.
32. Dewar, W.K., P.B. Rhines and W.R. Young, 1984, The nonlinear spin-up of a stratified ocean, *Geophys. Astrophys. Fluid Dyn.* 30, 169-197.
33. Read, P.L., P.B. Rhines and A.A. White, 1986, Geostrophic scatter diagrams and potential vorticity dynamics, *J. Atmos. Sci.* 43, 3226-3240.
34. Rhines, P.B., 1986, Vorticity dynamics of the ocean general circulation, *Ann. Rev. Fluid Mech.* 18, 433-497.
35. Rhines, P.B., 1986, Lectures on ocean circulation dynamics, *in Large-Scale Transport Processes in Oceans and Atmospheres*, D. Anderson and J. Willebrand Eds. Reidel, Dordrecht. 105-161
36. Rhines, P.B., 1988, Mixing and large-scale ocean dynamics, *in Proc. XIXth Liege Symposium on Ocean Hydrodynamics*, J.C. Nihoul Ed., Elsevier, 263-284
37. Rhines, P.B., 1989, Deep planetary circulation over topography: simple models of mid-ocean flows. *J. Phys. Oceanogr.* 19, 1449-1470.
38. Hermann, A.L., P.B. Rhines and E.R. Johnson, 1989, Nonlinear Rossby adjustment in a channel: beyond Kelvin waves, *J. Fluid Mech.* 205, 460-502.
39. Straub, D.N. and P.B. Rhines, 1989, Effects of large-scale topography on abyssal circulation, *J. Marine Res.* 48, 223-253
40. G. Holloway and P.B. Rhines, 1990, Angular momenta of modeled ocean gyres, *J. Geophys. Res.* 96, 843-846.
41. MacCready, P.M. and P.B. Rhines, 1991, Buoyant inhibition of Ekman transport on a slope and its effect on stratified spin-up, *J. Fluid Mech.* 223, 631-661.
42. Rhines, P.B. and R. Schopp, 1991, Wind-driven circulation: theory and quasigeostrophic simulations for non-symmetric winds, *J. Phys. Oceanogr.* 21, 1438-1469. (Cox Memorial vol.)
43. MacCready, P.M. and P.B. Rhines, 1993, Arrested Ekman layers on a slope, *J. Phys. Oceanography*, 23, 5-22.
44. Garrett, C.J.R., P.M. MacCready and P.B. Rhines, 1993, Boundary mixing and arrested Ekman layers: rotating stratified flow near a sloping boundary, *Ann. Revs. Fluid Mech.*, 25, 291-323.
45. Rhines, P.B., 1993, Oceanic general circulation: wave- and advection dynamics, *in Modelling Oceanic Climate Interactions*, J. Willebrand and D. Anderson eds., NATO ASI series, Springer, Berlin., 67-149.
46. Condie, S.A. and P.B. Rhines, 1994, Topographic Hadley cells,

*J.Fluid Mech.*, 280, 349-366.

47. Condie, S.A. and P.B. Rhines, 1994, Superadiabatic jets on Jupiter and Saturn, *Nature*, 367, 711-713.
48. Rhines, P.B., 1994, Jets, *Chaos* 4, 313-341, Amer.Inst.of Physics 51.
49. Hallberg, R. and P.B.Rhines, 1996, Buoyancy driven circulations in an ocean basin with isopycnals intersecting the sloping boundary, *J.Phys.Oceanogr.*, 26, 913-940.
50. Dickson, R.R., J.R.N.Lazier, J.Meinke, P.B.Rhines, and J.Swift 1996, Long-term coordinated changes in the convective activity of the North Atlantic, *Prog. Oceanogr.* 38, 241-295.
51. Pierce, D.P. and P.B. Rhines, 1996, Convective building of a pycnocline, part A: laboratory experiments, *J. Phys. Oceanogr.*, 26, 176-190
52. Pierce, D.P. and P.B.Rhines, 1997, Convective building of a pycnocline: a two-dimensional non-hydrostatic numerical model, *J. Phys. Oceanogr.* 27, 909-925.
53. Ohlsen, D. and P.B. Rhines, 1997, Laboratory experiments on equatorially trapped waves using ferrofluid. *J.Fluid Mech.*, 338, 35-58.
54. Rhines, P.B., 1997, Geostrophic turbulence and geophysical circulations, *in* Two-Dimensional Turbulence in Plasmas and Fluids, R.L.Dewar and R.W. Griffiths eds., Amer. Inst. of Physics Press., Woodbury, NY, 91-112.
55. Rhines, P.B., 1998, Circulation, convection and mixing in rotating, stratified basins with sloping topography, *in* Physical Processes in Lakes and Oceans, J.Imberger Ed., AGU Coastal and Estuarine Series 54, 435-451.
56. Lab Sea Group, 1998: The Labrador Sea Deep Convection Experiment, *Bull.Amer.Met.Soc.* 79, 2033-2058.
57. Lilly, J.M., P.B. Rhines, M.Visbeck, R.Davis, J.R.N.Lazier, F.Schott, D.Farmer, 1999: Observing deep convection in the Labrador Sea during winter, 1994-1995., *J.Phys. Oceanogr.* 29, 2065-2098.
58. Rhines, P.B., 1999: Marine natural disasters, *in* Monsoons to Microbes, the Dimensions of Human Health and the Oceans, W.Fenical Ed., Natl. Acad. Sci. Press, Washington D.C., 260 pp.
59. Boubnov, B.M. and P.B.Rhines, 1999: Effect of topography on a localized convection of a rotating fluid in shallow vessels, *Izvestia Akademii Nauk Fizika Atmosfery Okeana* 1999, 35, 356-363.
60. Lazier, J.R.N., R.Pickart and P.B.Rhines, 2000: Deep convection in Ocean Circulation and Climate, *in* Observing and Modelling the Global Ocean, J.Church, G.Siedler and J.Gould eds., Academic Press, 387-401.
61. Hallberg, R.W. and P.B.Rhines, 2000: Boundary sources of potential vorticity in geophysical circulations, *in* Developments in Geophysical Turbulence, R.Kerr Ed., Kluwer Academic Pub., Netherlands, 51-66.
62. MacCready, Parker, Peter B. Rhines, 2001: Meridional Transport across a Zonal Channel: Topographic Localization. *J. Phys. Oceanogr.* 31, 1427-1439.
63. Lilly, J.M. and P.B.Rhines, 2002: Coherent eddies in the Labrador Sea observed from a mooring, *J.Phys.Oceanogr.* 32, 585-598
64. Cuny, J., P.B.Rhines, P.P.Niiler and S.Bacon, 2002: Labrador Sea boundary currents and the fate of the Irminger Sea Water, *J.Phys. Oceanogr.* 32, 627-647.
65. Thomas, L. and P.B. Rhines, 2002: Nonlinear stratified spin-up.

- J. Fluid Mech.* 25 Dec. 473, 211-244.
66. Lazier, J.R.N., R. Hendry, A. Clarke, I. Yashayaev and P. Rhines, 2002: Convection and restratification in the Labrador Sea, 1990-2000. *Deep-Sea Res.* 49, 1819-1835.
  67. Alley, R.B., J. Marotzke, W.D. Nordhaus, J.T. Overpeck, D.M. Peteet, R. Pielke, Jr., R.T. Pierrehumbert, P.B. Rhines, T.F. Stocker, L.D. Talley and J.M. Wallace, 2003: Abrupt climate change. *Science* 299, 2005-2010.
  68. Lilly, J.M., P.B. Rhines, F. Schott, K. Lavender, J. Lazier, U. Send and E. d'Asaro, 2003: Observations of the Labrador Sea eddy field. *Prog. in Oceanogr* 59, 75-176.
  69. Cheng, W. and P.B. Rhines, 2003: Response of the overturning circulation to regional fresh water perturbations in the North Atlantic, *Clim. Dyn.*, 22, 359-372
  70. Häkkinen, S. and P.B. Rhines, 2004: Decline of the North Atlantic subpolar circulation in the 1990s. *Science*, 304, 555-559.
  71. Bailey, D., P.B. Rhines and S. Hakkinen, 2005: Pathways and formation of North Atlantic Deep Water in a coupled ice-ocean model of the Arctic-North Atlantic Oceans. *Climate Dynamics*, 24, 10.1007/s00382-005-0050-3
  72. Cuny, J., P.B. Rhines, R. Kwok, 2005: Davis Strait volume, freshwater and heat fluxes, *Deep-Sea Res.* 52, 519-542
  73. Cuny, J., P.B. Rhines, J. Lazier, F. Schott, 2005: Convection above the Labrador Slope. *J. Phys. Oceanogr.* 35, 489-511.
  74. Rhines, P.B. 2006: Sub-Arctic oceans and global climate, *Weather*, 61, 109-118.
  75. Rhines, P.B., E.G. Lindahl and A.J. Mendez, 2007: Optical Altimetry: a new method for observing rotating fluids with applications to Rossby waves on a polar beta-plane. *J. Fluid Mech.* 572, 389-412.
  76. Baldwin, M., P.B. Rhines, H-P Huang, M.E. McIntyre, 2007: The jet-stream conundrum. *Science*, 315, 26 January 2007, 467-468.
  77. Hatun, H, C.E. Eriksen and P.B. Rhines, 2007: Buoyant eddies entering the Labrador Sea observed with gliders and altimetry, *J. Phys. Oceanogr.* 37, 2838-2854.
  78. Rhines, P.B., 2007: Jets and orography: idealized experiments with tip-jets and Lighthill blocking. *J. Atmos. Sci.*, October 2007, 3627-3639, DOI: 10.1177/JAS4008.1
  79. Jung, T. and P.B. Rhines, 2007: Aspects of Greenland's influence on wintertime atmospheric flow. *J. Atmos. Sci.* 64, 4004-4030.
  80. Hakkinen, S., H. Hatun and P.B. Rhines, 2008: Satellite evidence of change in the Northern Gyre, in *The subarctic seas as sources of Arctic change*, R.R. Dickson, J. Meincke and P.B. Rhines eds., Springer, 551-568.
  81. Afanasyev, Y.D., P.B. Rhines and E.G. Lindahl, 2008: Interaction of vortices and Rossby waves on the polar  $\beta$ -plane by altimetric imaging velocimetry. *Physics of Fluids*, accepted. 20, 086604\_2008\_ DOI: [10.1063/1.2968451](https://doi.org/10.1063/1.2968451)
  82. Afanasyev, Y.D., P.B. Rhines and E.G. Lindahl, 2008: Emission of inertial waves by baroclinically unstable flows: laboratory experiments with Altimetric Imaging Velocimetry. *J. Atmos. Sci.* 65, 250-262.
  83. Rhines, P.B., S. Hakkinen and S. Josey, 2008: The role of oceans in global climate, in *The subarctic seas as sources of Arctic change*, R.R. Dickson,

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### **Films, television**

- 2002 Lectures on ocean circulation: PBS series "Oceanography"
- 2001 Contributions to "Planet Storm", Granada Television (UK) and Discovery Channel (US and Canada)
- 1999 Contributions to "The Big Chill", BBC-2 Television
- 1981 Lecture on ocean dynamics, "Under the Weather", BBC Television
- 1978 Lecture on ocean dynamics. BBC Television Open University
- 1974 Contributions to "The Turbulent Ocean", Nova (Horizon in U.K.), Public Broadcasting System
- 1973 The MODE SOFAR Floats. National Center for Atmospheric Research
- 1970 Topographic and Rossby Waves (computer generated). National Center for Atmospheric Research

### **Public Lectures**

- 2007 Nisqually Wildlife Refuge 20<sup>th</sup> anniversary Summer Lecture Series: "The future of water"
- 2004 Nisqually Wildlife Refuge: "Climate change and the Arctic"
- 2001 KUOW – Seattle Weekday – 21 Dec. 2001 "Global Warming"
- 2001 Oceans to Stars Lectures, Univ. of Washington, "Exploring the Cold Oceans of the North"
- 1999 Monadnock Summer Lyceum, NH and New Hampshire Public Radio "A Scientific Voyage Through Climate and Time"
- 1994 Monadnock Summer Lyceum, NH, New Hampshire Public Radio "Exploring the Cold Oceans of the North"

### **Technical Reports**

Mills, C.A. and P.B. Rhines, 1979, The deep western boundary current at the Blake-Bahama Outer Ridge: current meter and temperature observations, 1977-78. Woods Hole Oceanographic Institution Technical Report WHOI-79-85.

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## Current Research Grants

NSF grants for: •Geophysical Fluid Dynamics Lab;  
•Seaglider observation network between Iceland and Scotland  
NASA (Ocean Surface Topography Science Team; altimetry and ocean circulation)  
NOAA-Seaglider deployments in the Subpolar Atlantic Ocean

## Field Work

1. R/V Chain cruise, March 1968, spring warming of the No. Atlantic mixed layer
2. R/V Gosnold cruise, April 1969, wave buoys in Buzzard's Bay Massachusetts (Chief Scientist).
3. R/V Knorr cruise 7, July 1970, velocity profiling in the Gulf Stream
4. R/V Oceanus cruise 21, January 1977, hydrography and SOFAR floats in deep western boundary current, Bahamas area (Chief Scientist)
5. R/V Oceanus cruise 31, August 1977, hydrography and current meter work in deep western boundary current, Blake-Bahama Outer Ridge (Co-Chief Scientist)
6. R/V Atlantis II cruise 100, May 1978, hydrography and current meter work in Gulf Stream recirculation and deep boundary current
7. R/V Knorr cruise 89, August-September 1981, trace chemistry and hydrography of Irminger and Labrador Seas, Reykjavik to St. Johns (Co-Chief Scientist)
8. R/V Knorr cruise 99, December 1982, trace chemistry and hydrography of tropical Atlantic, San Juan to Belem
9. R/V Knorr cruise 134, November-December 1987, trace chemistry and hydrography of South Atlantic, Recife to Abidjan (co-chief scientist).
10. CSS Hudson cruise 93-019, June 1993, convected water in the Labrador Sea.
11. CSS Hudson cruise, May-June 1994, convected water and setting a climate mooring, Labrador Sea
12. CSS Hudson cruise 96-037, Oct.-Nov. 1996, Labrador Sea.
13. R/V Tincan, estuary dynamics studies, July/August 1999, San Juan Islands, Washington, project leader
14. Hans Egede, Seaglider launches in coastal waters off Nuuk, west Greenland, Sept -Oct. 2003
15. R/V Håkon Mosby, Tromsø, Norway to Svalbard, hydrography of dense overflow waters in the Storfjorden, with Ilker Fer, Aug 2005.