

**Michael A. Spall**

Physical Oceanographer  
Senior Scientist  
Department of Physical Oceanography  
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B.S., Clarkson College of Technology, 1980 (Mechanical Engineering)

M.S., Clarkson College of Technology, 1982 (Mechanical Engineering)

S.M., Harvard University, 1984 (Applied Mathematics)

Ph.D., Harvard University, 1988 (Applied Mathematics)

Staff Engineer, TRW, Redondo Beach, California, 1982–1983

Research Assistant, Harvard University, 1984–1988

Visiting Scientist, National Center for Atmospheric Research, Boulder, Colorado, 1988–1989

Visiting Scientist, Institut für Meereskunde, Kiel, Germany, 1992

Assistant Scientist, 1990–1993; Associate Scientist, 1993–June 2002; tenure awarded 1997;  
Senior Scientist June 2002–present; Woods Hole Oceanographic Institution

Editor, *Journal of Physical Oceanography*, 2002–present, Chief Editor, 2009–present

Editorial Board Member, *Journal of Marine Science and Engineering*, 2012–present

Editorial Board Member, *Dynamics of Atmospheres and Oceans*, 1998–2007

Associate Editor, *Journal of Geophysical Research*, 2000–2004

Editor, *Journal of Geophysical Research*, 1999–2000

Scientific Steering Committee Member at Large, CLIVAR, 2009–2011

Research Interests: Dynamics of mid-latitude subtropical and subpolar gyres, frontal dynamics and mesoscale variability, thermohaline circulation, water mass transformation in marginal seas.

Author or co-author of 79 refereed scientific publications.

## Refereed Publications

- Robinson, Allan R., Michael A. Spall, and Nadia Pinardi, 1988. Gulf Stream simulation and the dynamics of ring and meander processes. *Journal of Physical Oceanography*, **18**(12), 1811–1853.
- Robinson, Allan R., Michael A. Spall, Leonard J. Walstad, and Wayne G. Leslie, 1989. Data assimilation and dynamical interpolation in GULFCASTING experiments. *Dynamics of Atmospheres and Oceans*, **13**, 301–316.
- Spall, Michael A., 1989. Regional primitive equation modeling and analysis of the POLYMODE data set. *Dynamics of Atmospheres and Oceans*, **14**(1–2), 125–174.
- Spall, Michael A., and Allan R. Robinson, 1989. A new hybrid coordinate open ocean primitive equation model. *Mathematics and Computers in Simulation*, **31**, 241–269.
- Spall, Michael A., 1990. Circulation in the Canary Basin: a model/data analysis. *Journal of Geophysical Research*, **95**(C6), 9611–9628.
- Spall, Michael A., and Allan R. Robinson, 1990. Regional primitive equation studies of the Gulf Stream meander and ring formation region. *Journal of Physical Oceanography*, **20**(7), 985–1016.
- Spall, Michael A., 1991. A diagnostic study of the wind and buoyancy driven North Atlantic Circulation. *Journal of Geophysical Research*, **96**(C10), 18,509–18,518.
- Spall, Michael A., and William R. Holland, 1991. A nested primitive equation model for oceanic applications. *Journal of Physical Oceanography*, **21**(2), 205–220.
- Spall, Michael A., 1992. Cooling spirals and recirculation in the subtropical gyre. *Journal of Physical Oceanography*, **22**(5), 564–571.
- Spall, Michael A., 1992. Rossby wave radiation in the Cape Verde Frontal Zone. *Journal of Physical Oceanography*, **22**(7), 796–807.
- Spall, Michael A., and James C. McWilliams, 1992. Rotational and gravitational influences on the degree of balance in the shallow water equations. *Geophysical and Astrophysical Fluid Dynamics*, **64**, 1–29.
- Spall, Michael A., 1993. Variability of sea surface salinity in stochastically forced systems. *Climate Dynamics*, **8**, 151–160.
- Spall, Michael A., Philip L. Richardson, and James Price, 1993. Advection and eddy mixing in the Mediterranean salt tongue. *Journal of Marine Research*, **51**(4), 797–818.

- Polvani, L. M., J. C. McWilliams, M. A. Spall, and R. Ford, 1994. The coherent structures of shallow-water turbulence: Deformation-radius effects, symmetry breaking and gravity-wave generation. *Chaos*, **4**(2), 177–186.
- Spall, Michael A., 1994. A mechanism for low frequency variability and salt flux in the Mediterranean salt tongue. *Journal of Geophysical Research*, **99**(C5), 10,121–10,129.
- Spall, Michael A., 1994. Wave-induced abyssal recirculations. *Journal of Marine Research*, **52**, 1051–1080.
- Spall, Michael A., 1995. Frontogenesis, subduction, and cross-front exchange at upper ocean fronts. *Journal of Geophysical Research*, **100**(C2), 2543–2557.
- Williams, Richard G., Michael A. Spall, and John C. Marshall, 1995. Does Stommel's mixed-layer 'demon' work? *Journal of Physical Oceanography*, **25**(12), 3089–3102.
- Spall, Michael A., 1996. Dynamics of the Gulf Stream/Deep Western Boundary Current Crossover. Part I: Entrainment and recirculation. *Journal of Physical Oceanography*, **26**(10), 2152–2168.
- Spall, Michael A., 1996. Dynamics of the Gulf Stream/Deep Western Boundary Current Crossover. Part II: Low-frequency internal oscillations. *Journal of Physical Oceanography*, **26**, 2169–2182.
- Pedlosky, Joseph, Lawrence J. Pratt, Michael A. Spall, and Karl R. Helfrich, 1997. Circulation around islands and ridges. *Journal of Marine Research*, **55**(6), 1199–1251.
- Pickart, Robert S., and Michael A. Spall, and J. R. N. Lazier, 1997. Mid-depth ventilation in the western boundary current system of the subpolar gyre. *Deep-Sea Research I*, **44**(6), 1025–1054.
- Spall, M. A., 1997. Baroclinic jets in confluent flow. *Journal of Physical Oceanography*, **27**(6), 1054–1071.
- Visbeck, Martin, John Marshall, Tom Haine, and Mike Spall, 1997. Specification of eddy transfer coefficients in coarse-resolution ocean circulation models. *Journal of Physical Oceanography*, **27**(3), 381–402.
- Spall, Michael A., and David C. Chapman, 1998. On the efficiency of baroclinic eddy heat transport across narrow fronts. *Journal of Physical Oceanography*, **28**(11), 2275–2287.
- Spall, Michael A., and James F. Price, 1998. Mesoscale variability in Denmark Strait: The PV outflow hypothesis. *Journal of Physical Oceanography*, **28**(8), 1598–1623.
- Pedlosky, Joseph, and Michael Spall, 1999. Rossby normal modes in basins with barriers. *Journal of Physical Oceanography*, **29**(9), 2332–2349.

- Spall, Michael A., 1999. A simple model of the large scale circulation of Mediterranean water and Labrador Sea water. *Deep-Sea Research II*, **46**, 181–204.
- Joyce, Terrence M., Clara Deser, and Michael A. Spall, 2000. On the relation between decadal variability of Subtropical Mode Water and the North Atlantic Oscillation. *Journal of Climate*, **13**, 2550–2569.
- Spall, Michael A., 2000. Buoyancy-forced circulations around islands and ridges. *Journal of Marine Research*, **58**(6), 957–982.
- Spall, Michael A., 2000. Generation of strong mesoscale eddies by weak ocean gyres. *Journal of Marine Research*, **58**(1), 97–116.
- Spall, Michael A., Robert A. Weller, and Peter W. Furey, 2000. Modeling the three-dimensional upper ocean heat budget and subduction rate during the Subduction Experiment. *Journal of Geophysical Research*, **105**(C11), 26,151–26,166.
- Blackmon, Maurice, Byron Boville, Frank Bryan, Robert Dickinson, Peter Gent, Jeffrey Kiehl, Richard Moritz, David Randall, Jagadish Shukla, Susan Solomon, Gordon Bonan, Scott Doney, Inez Fung, James Hack, Elizabeth Hunke, James Hurrell, John Kutzbach, Jerry Meehl, Bette Otto-Bliesner, R. Saravanan, Edwin K. Schneider, Lisa Sloan, Michael Spall, Karl Taylor, Joseph Tribbia, and Warren Washington, 2001. The community climate system model. *Bulletin of the American Meteorological Society*, **82**, 2357–2376.
- Spall, M. A., 2001. Large-scale circulations forced by localized mixing over a sloping bottom. *Journal of Physical Oceanography*, **31**(8, Part 2), 2369–2384.
- Spall, M. A., and R. S. Pickart, 2001. Where does dense water sink? A subpolar gyre example. *Journal of Physical Oceanography*, **31**(3), 810–826.
- Spall, M. A., 2002. Wind- and buoyancy-forced upper ocean circulation in two-strait marginal seas with application to the Japan/East Sea. *Journal of Geophysical Research*, **107**, 10.1029-2001JC000966.
- Pickart, R. S., M. A. Spall, M. H. Ribergaard, G. W. K. Moore, and R. F. Milliff, 2003. Deep convection in the Irminger Sea forced by the Greenland tip jet. *Nature*, **424**, 152–156.
- Pratt, L. J., and M. A. Spall, 2003. A porous media theory for geostrophic flow through ridges and archipelagos. *Journal of Physical Oceanography*, **33**, 2702–2718.
- Spall, M. A., 2003. Islands in zonal flow. *Journal of Physical Oceanography*, **33**, 2689–2701.
- Spall, M. A., 2003. The thermohaline circulation in flat bottom marginal seas. *Journal of Marine Research*, **61**, 1–25.
- Spall, M. A., and R. S. Pickart, 2003. Wind-driven recirculations and exchange in the Labrador and Irminger Seas. *Journal of Physical Oceanography*, **33**, 1829–1845.

- Katsman, C., M. A. Spall, and R. S. Pickart, 2004. Boundary current eddies and their role in the restratification of the Labrador Sea. *Journal of Physical Oceanography*, **34**, 1967–1983.
- Spall, M. A., 2004. Boundary currents and water mass transformation in marginal seas. *Journal of Physical Oceanography*, **34**, 1197–1213.
- Weller, R. A., P. W. Furey, M. A. Spall, and R. E. Davis, 2004. The large-scale context for oceanic subduction in the northeast Atlantic. *Deep Sea Research*, **51**, 665–699.
- Pedlosky, J., and M. A. Spall, 2005. Boundary intensification of vertical velocity in a beta-plane basin. *Journal of Physical Oceanography*, **35**, 2487–2500.
- Spall, M. A., 2005. Buoyancy-forced circulations in shallow marginal seas. *Journal of Marine Research*, **63**, 729–752.
- Spall, M. A., and J. Pedlosky, 2005. Reflection and transmission of equatorial Rossby waves. *Journal of Physical Oceanography*, **35**, 363–373.
- Pickart, R. S., and M. A. Spall, 2007. Impact of Labrador Sea Convection on the North Atlantic Meridional Overturning Circulation. *Journal of Physical Oceanography*, **37**(9), 2207–2227.
- Spall, M. A., 2007. Circulation and water mass transformation in a model of the Chukchi Sea. *Journal of Geophysical Research*, **112**, C0525, doi:10.1029/2005JC002264.
- Spall, M. A., 2007. Effect of sea surface temperature-wind stress coupling on baroclinic instability in the ocean. *Journal of Physical Oceanography*, **37**(4), 1092–1097.
- Spall, M. A., 2007. Mid-latitude wind stress/sea surface temperature coupling in the vicinity of oceanic fronts. *Journal of Climate*, **20**, 3785–3801.
- Spall, M. A., and J. Pedlosky, 2008. Lateral coupling in baroclinically unstable flows. *Journal of Physical Oceanography*, **38**, 1267–1277.
- Spall, M. A., R. S. Pickart, P. S. Fratantoni, and A. J. Plueddemann, 2008. Western Arctic shelfbreak eddies: Formation and transport. *Journal of Physical Oceanography*, **38**, 1644–1668.
- Small, R. J., S. deSzoeko, S. P. Xie, L. O’Neill, H. Seo, Q. Song, P. Cornillon, M. Spall, and S. Minobe, 2008. Air-sea interaction over ocean fronts. *Dyn. Atmos. Oceans*, doi:10.1016/j.dynatmoce.2008.01.001.
- Hristova, H., J. Pedlosky, and M. A. Spall, 2008. Radiating instability of a meridional boundary current. *Journal of Physical Oceanography*, **38**(10), 2294–2307.
- Spall, M. A., and J. Pedlosky, 2008. Lateral coupling in baroclinically unstable flows. *Journal of Physical Oceanography*, (**38**), 1267–1277.

- Spall, M. A., R. S. Pickart, P. S. Fratantoni, and A. J. Plueddemann, 2008. Western Arctic shelfbreak eddies: Formation and transport. *Journal of Physical Oceanography*, **38**, 1644-1668.
- Iovino, D., F. Straneo, and M. A. Spall, 2008. On the effect of a sill on dense water formation in a marginal sea. *Journal of Marine Research*, **66**(3), 325-345.
- Pratt, L. J., and M. A. Spall, 2008. Circulation and exchange in choked marginal seas. *Journal of Physical Oceanography*, **38**(12), 2639-2661.
- Spall, M. A., 2008. Buoyancy-forced downwelling in boundary currents. *Journal of Physical Oceanography*, **38**(12), 2704-2721.
- Spall, M. A., 2008. Low frequency interaction between horizontal and overturning gyres in the ocean. *Geophys. Res. Lett.*, **35**, L18614, doi: 10.1029/2008GL035206.
- Durland, T. S., J. Pedlosky, and M. A. Spall, 2009. Response to a steady poleward outflow, Part I: The linear quasigeostrophic problem. *Journal of Physical Oceanography*, **39**(7), 1541-1550.
- Durland, T. S., M. A. Spall, J. Pedlosky, 2009. Response to a steady poleward outflow, Part II: oscillations and eddies, *Journal of Physical Oceanography*, **39**(7), 1551–1573.
- Deshayes, J. , F. Straneo and M. Spall, 2009. Mechanisms of variability in a convective basin. *Journal of Marine Research*, **67**(3) 273-303.
- Spall, M. A., 2010. Non-local topographic influences on deep convection: An idealized model for the Nordic Seas. *Ocean Modeling*, **32**, 72-85.
- Spall, M. A., 2010. Dynamics of downwelling in an eddy-resolving convective basin. *Journal of Physical Oceanography*, **40**(10), 2341-2347. Doi:10.1175/2010JPO4465.1.
- Hristova, H., H. Dijkstra, and M. Spall, 2010. Onset of time-dependence in a double-gyre circulation: barotropic basin modes versus classical baroclinic modes. *Journal of Marine Research*, **68**, 215-236.
- Pickart, R. S., M. A. Spall, G. W. K. Moore, T. J. Weingartner, R. A. Woodgate, K. Aagaard, and K. Shimada, 2011. Upwelling in the Alaskan Beaufort Sea: Atmospheric forcing and local versus non-local response. *Progress in Oceanography*, **88**, 78-100, doi.10.1016/j.ocean.2010.11.005.
- Våge, K., R. S. Pickart, M. A. Spall, H. Valdimarsson, S. Jónsson, D. J. Torres, S. Osterhus, and T. Eldevik, 2011. Significant role of the North Icelandic Jet in the formation of Denmark Strait overflow water. *Nature Geosciences*. Doi:10.1038/NGEO1234.
- Spall, M. A., 2011. On the role of eddies and surface forcing in the heat transport and overturning circulation in marginal seas. *Journal of Climate*, **24**, 4844-4858.

- Pedlosky, J., R. Iacono, E. Napolitano, and M. Spall, 2011. The two-layer skirted island. *Journal of Marine Research*, **69**, 347-382.
- Wang, J., M. A. Spall, G. R. Flierl, and P. Malanotte-Rizzoli, 2012. A new mechanism for the generation of quasi-zonal jets in the ocean. *Geophysical Research Letters*, doi:10.1029/2012GL051861.
- Spall, M. A., 2012. Influences of precipitation on water mass transformation and deep convection. *Journal of Physical Oceanography*, **42**, 1684-1700.
- Pickart, R. S., M. A. Spall, and J. T. Mathis, 2013. Dynamics of upwelling in the Alaskan Beaufort Sea and associated shelf-basin fluxes. *Deep Sea Res.*, in press.
- Spall, M. A., and J. Pedlosky, 2013. Interaction of Ekman layers and islands. *Journal of Physical Oceanography*, in press.
- Wang, J., M. A. Spall, G. R. Flierl, P. Malanotte-Rizzoli, 2013: Nonlinear radiating instability of a barotropic eastern boundary current. *J. Phys. Oceanogr.*, in press.
- Spall, M. A., 2013: Dense water formation around islands. *J. Geophys. Res.*, accepted.
- Spall, M. A., 2013: On the circulation of Atlantic Water in the Arctic Ocean. *J. Phys. Oceanogr.*, submitted.

### **Non-Refereed Publications**

- Glenn, S. M., Allan R. Robinson, and Michael A. Spall, 1987. Recent results from the Harvard Gulf Stream forecasting program. *Oceanogr. Mon. Summary*, U.S. Department of Commerce, NOAA, **7**(4), 12-13.
- Robinson, Allan R., S. M. Glenn, Michael A. Spall, Leonard J. Walstad, G. Gardner, and W. G. Leslie, 1989. Forecasting Gulf Stream meanders and rings. *Eos, Transactions, American Geophysical Union*, **70**(45), 1464-1473.
- Spall, Michael A., 1990. Model and data analysis in the Canary Basin. Congress on Oceanography and Marine Resources in the Central-East Atlantic, Centro de Tecnologia Pesquera, Excmo. Cabildo Insular de Gran Canaria, Islas Canarias, España.
- Spall, Michael A., 1991. Cooling spirals and recirculation in the subtropical gyre. Eighth Conference on Atmospheric and Oceanic Waves and Stability, October 14-18, 1991, Denver, Colorado; American Meteorological Society, Boston, Massachusetts; pp. 3-6.
- Spall, Michael A., 1993. A mechanism for low frequency variability and salt flux in the Mediterranean salt tongue. Ninth Conference on Atmospheric and Oceanic Waves and Stability. May 1993, American Meteorological Society, San Antonio, Texas.

- Spall, Michael A., 1993. Advection and transport in the Mediterranean salt tongue. Colloquium on modelling of ocean vortices, May 11-14, Amsterdam, The Netherlands; Netherlands Royal Academy of Arts and Sciences.
- Spall, Michael A., 1994. Wave induced abyssal recirculations in the Brazil Basin. Ocean Sciences meeting, January 1994, American Geophysical Union, San Diego, California.
- Pickart, R. S., and M. A. Spall, 1995. Mid-depth ventilation along the western boundary of the sub-polar gyre. *ACCP Notes*, **II**, 9-11.
- Pickart, R. S., and M. A. Spall, 1995. Mid-depth ventilation of the western boundary current system in the subpolar gyre. European Geophysical Society, April 1995, Wiesbaden, Germany.
- Polvani, L., J. C. McWilliams, M. A. Spall, and R. Ford, 1995. The coherent structures of shallow water turbulence: Deformation radius effects, cyclone/anticyclone asymmetry and gravity-wave generation. Atmospheric Waves and Stability Meeting, June 1995, Big Sky, Montana.
- Spall, M. A., 1995. A low frequency oscillator in the Gulf Stream/Deep Western Boundary Current system. Extended abstract in the NOAA Atlantic Climate Change Program Principal Investigator Meeting, May 2-4, Miami, Florida.
- Spall, M. A., 1995. Low frequency oscillations in the Gulf Stream/Deep Western Boundary Current system. Atmospheric Waves and Stability Meeting, June 1995, Big Sky, Montana.
- Spall, M. A., 1995. Mixing and transport in the Mediterranean salt tongue. *Modelling of Oceanic Vortices*, G. J. F. van Heijst, editor, North-Holland, Amsterdam.
- Weller, R. A., K. Moyer, and M. A. Spall, 1995. Upper ocean response to atmospheric forcing during the subduction experiment: Comparison of observations and 1-D mixed layer models. The XXI General Assembly of the International Association for the Physical Sciences of the Oceans, August 5-12, Honolulu, Hawaii.
- Williams, R. C., M. A. Spall, and J. C. Marshall, 1995. Subduction of water masses and tracers: What is the impact of eddy stirring? The XXI General Assembly of the International Association for the Physical Sciences of the Oceans, August 5-12, Honolulu, Hawaii.
- Lozier, M. S., and M. A. Spall, 1996. Dynamics of mid-latitude interactions between LSW and the Gulf Stream system: Analysis of the modern hydrographic record. Extended abstract in the NOAA Atlantic Climate Change Program Principal Investigator meeting, May 14-17, Woods Hole, Massachusetts.
- Pratt, L., J. Pedlosky, M. A. Spall, and K. Helfrich, 1996. Wind driven circulation around islands. Extended abstract in the AGU Fall Meeting, December 16, 1996, San Francisco, California.



- Spall, M. A., 1996. A low frequency oscillation in the Gulf Stream/DWBC system. *ACCP Notes*, **III**, 1-4.
- Spall, M. A., and M. S. Lozier, 1996. Dynamics of mid-latitude interactions between LSW and the Gulf Stream system: Idealized modeling studies. Extended abstract in the NOAA Atlantic Climate Change Program Principal Investigator meeting, May 14-17, Woods Hole, Massachusetts.
- Spall, M. A., and J. F. Price, 1997. Mesoscale variability in Denmark Strait: The PV outflow hypothesis. European Geophysical Society, April, Vienna, Austria.
- Spall, M. A., 1997. Tracer transport by steady and unstable beta plumes with application to the Mediterranean salt tongue. European Geophysical Society, April, Vienna, Austria.
- Pedlosky, J., and M. A. Spall, 1998. Rossby normal modes in basins with barriers. American Geophysical Union meeting, December, San Francisco, California.
- Pedlosky, Joseph, and Michael Spall, 1998. Crossing the ridge: Rossby Wave tunneling. Woods Hole Oceanographic Institution 1998 Annual Report, pp. 23-24.
- Price, J. F., and M. A. Spall, 1998. Mesoscale variability in Denmark Strait: The PV outflow hypothesis. Ocean Sciences Meeting, February, San Diego, California.
- Spall, M. A., 1998. A simple model of the large scale circulation of Mediterranean Water and Labrador Sea Water. Ocean Sciences Meeting, February, San Diego, California.
- Spall, M. A., 1999. An overview of ACCE modeling and data assimilation. AGU meeting, May, Boston, Massachusetts.
- Spall, M. A., and R. S. Pickart, 1999. Boundary convection and meridional overturning. AGU meeting, May, Boston, Massachusetts.
- Spall, M. A., 2000. Boundary currents and the thermohaline circulation. Ocean Sciences meeting, January, San Antonio, Texas.
- Spall, M. A., 2000. Generation of strong mesoscale eddies from weak ocean gyres. Ocean Sciences meeting, January, San Antonio, Texas.
- Spall, M. A., and R. S. Pickart, 2000. On the downwelling limb of the thermohaline circulation. *WOCE Implementation Report Number 12*, U.S. WOCE Office, College Station, Texas, pp. 43-46.
- Spall, M. A., 2001. Forward problem in numerical models. In: *Encyclopedia of Ocean Sciences*, John H. Steele, Steve A. Thorpe, and Karl K. Turekian, Editors, Academic Press, San Diego; Vol. 2, pp. 1088-1095.
- Spall, M. A., 2001. On the wind- and buoyancy-forced upper ocean circulation in the Japan/East Sea. Proceedings of the CREAMS 2001 International Symposium, Honolulu, Hawaii.

- Spall, M. A., 2003. Deep convection east of Greenland: Atmospheric forcing and oceanic response. *EGS*, Nice, France, April (abstract).
- Spall, M. A., 2003. Mixing near boundaries and the thermohaline circulation. *EGS*, Nice, France, April (abstract).
- Spall, M. A., 2004. On the thermohaline circulation in marginal seas. *EGS*, Nice, France, April (abstract).
- Pickart, R., and M. A. Spall, 2004. Heat transport in the Labrador Sea. *EGS*, Nice, France, April (abstract).
- Spall, M. A., and J. Pedlosky, 2004. Reflection and transmission of equatorial Rossby waves. Ocean Sciences Meeting, January, Portland, OR (abstract).
- Spall, M. A., 2011. Buoyancy-forced circulation and downwelling in marginal seas. Chapter in: *Buoyancy-Driven Flows*, Cambridge University Press.

### **Thesis and Technical Reports**

- Spall, Michael A., 1988. Regional ocean modeling: primitive equation and quasi-geostrophic studies. Ph.D. Thesis, Harvard University, Cambridge, Massachusetts. *Reports in Meteorology and Oceanography*, No. **24**, Harvard University, 282 pp.
- Spall, Michael A., 1988. Users' Guide to the Primitive Equation Energy and Vorticity Analysis Routine. *Reports in Meteorology and Oceanography*, No. **31**, Harvard University, 37 pp.
- Spall, Michael A., 1988. Users' Guide to the Regional Primitive Equation Model. *Reports in Meteorology and Oceanography*, No. **30**, Harvard University, 71 pp.