

# Raffaele Ferrari

## Associate Professor of Physical Oceanography

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### Education

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2000 PhD in Oceanography, Scripps Institution of Oceanography  
1999 PhD in Fluid Dynamics, Politecnico di Torino  
1994 MS and BS in Physics, Università di Torino

### Professional Experience

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2006–present Associate Professor with Tenure, Massachusetts Institute of Technology  
2002–2006 Assistant Professor, Massachusetts Institute of Technology  
2001–2002 Postdoctoral Scholar, Woods Hole Institution of Oceanography  
1995–2000 Graduate Research Assistant, Scripps Institution of Oceanography  
1994–1999 Visiting Scholar, Politecnico di Torino

### Awards and Honors

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2007 Cecil and Ida Green Professorship in Oceanography  
2007 Nicholas P. Fofonoff AMS Award  
2004 Killian and Lee Scholar Award  
2003 Victor P. Starr Career Development Chair  
2000 Woods Hole Postdoctoral Scholarship  
1999 Woods Hole Geophysical Fluid Dynamics Fellowship  
1998 NATO Advanced Study Institute Fellowship  
1995 Fulbright Fellowship

### Research Grants

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2007–2009 Renewal of National Science Foundation award to study “Eddy-mixed layers interactions” (leader of a team with 18 co-PIs from 10 different institutions)  
2005–2008 National Science Foundation award to study “CLIMODE” (with 10 co-PIs)  
2005–2008 Office of Naval Research award to study “Superparameterization in ocean modeling” (with one co-PI, J. Marshall)

2004–2007	National Science Foundation award to study “Eddy-mixed layers interactions” (leader of a team with 18 co-PIs from 10 different institutions)
2003–2006	National Science Foundation award to study “Parameterization of Eddy Fluxes in the Ocean Surface Mixed Layer” (single PI)
2003–2005	Office of Naval Research award to study “Finescale Structure of the Temperature-Salinity Relationship” (with one co-PI, K. Polzin)

## Teaching

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12.808	Introduction to Observational Oceanography (2004 and 2005)
12.820	Turbulent Motions in the Atmosphere and Oceans (2003 and 2004)
12.822	Turbulent Motions in the Atmosphere and Oceans (2005 and 2006)
12.803	Quasi-Balanced Circulations in Oceans and Atmospheres (2005)

## Professional Societies

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American Meteorological Society, American Geophysical Union, European Geophysical Society, European Geophysical Union

## Synergistic Activities

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Member of the organizing committee for the the 2007 ‘Aha Huliko’a Winter Workshop on “Extreme Events”, Honolulu, Hawaii

Leading PI of the Climate Process Team on “Eddy-Mixed Layers Interactions”, a National Clivar program funded to improve IPCC-class climate models

Member of the Process Studies and Model Improvement Panel for US CLIVAR

Organized a session on the “Role of Eddies in the Upper Ocean” at the Ocean Sciences meeting in Honolulu (February 2006)

Organized four workshops on “Eddy-Mixed Layer Interactions” in Boulder (February 2004), Princeton (June 2004), Providence (November 2004), and Princeton (September 2004)

Faculty member of the Geophysical Fluid Dynamics Summer Program in Woods Hole. Advised one student, Williams Frajka, in summer 2004

Reviewer for the National Academy of Sciences, the National Science Foundation and the journals Chaos, Deep Sea Research, Geophysical Research Letters, Journal of Climate, Journal of Geophysical Research, Journal of Fluid Mechanics, Journal of Marine Research, Journal of Physical Oceanography, Journal of the Atmospheric Sciences, and Nature

Graduate Student Mediator for the Earth, Atmospheric and Planetary Sciences Department of MIT

## Academic Service

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Chair of the Joint Program in Physical Oceanography between MIT and WHOI, 2006-2009

Chair of the EAPS Search Committee for a position in the area of Climate, 2005-2006

Chair of the General Exam Committee in the Program of Atmospheres, Oceans and Climate, 2006

Chair of the Joint Program General Exam Committee, 2005-2006 Member of the Rossby Award Committee (2004-5005), of the Joint Program General Exam Committee (2004-2005), of the Program of Atmospheres, Oceans and Climate General Exam Committee (2004), of the EAPS Graduate Committee (2002-2003), of the Victor Starr Memorial Lecture Committee (2002-2003), of the Joint Program in Physical Oceanography between MIT and WHOI (2002-2006), of the PAOC Educational Program Committee (2002-2005), Organizer of the PAOC Open House, 2002-2005  
Graduate Student Mediator for the Earth, Atmospheric and Planetary Sciences Department of MIT  
Serving on the thesis committees of Daniel Enderton, Tom Farrar, Ian Fenty, Gregory Gerbi, Hristina Hristova, Andrew Mosdale, Shaoyu Yuan, Yu Zhang

## Graduate and Postgraduate Advisees

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Present Undergraduate Students: Elizabeth Maroon, Erin Munsell  
Former Undergraduate Students: Valerie Wong, Amitra Masurkar  
Present Graduate Students: Jessica Benthuyesen, Maxim Nikurachine  
Former Graduate Students: Stephanie Waterman  
Present Postdoctoral Scholars: Baylor Fox-Kemper  
Former Postdoctoral Scholars: Giulio Boccaletti

## Graduate and Postgraduate Advisors

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Postgraduate Advisor: Joseph Pedlosky, Woods Hole Oceanographic Institution  
Graduate Advisor: Daniel L. Rudnick and William R. Young, Scripps Institution of Oceanography  
Undergraduate Advisor: Alfred Osborne, Università di Torino

## Publications

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### Refereed Journals

- Ferrari, R., M. Nikurachine, and E. Shuckburgh, Eddy diffusivities and mean flows in the Southern Ocean, *J. Phys. Oceanogr.*, in preparation.
- Ferrari, R., and Y. Lvov, Dispersion of passive tracers by internal waves, *J. Phys. Oceanogr.*, in preparation.
- Ferrari R., and D. Ferreira, On the wind-driven oceanic heat transport, *J. Climate*, in preparation.
- Fox-Kemper B., R. Ferrari, and R. Hallberg, Parameterization of Submesoscale Mixed Layer Eddies. II: Implementation in a General Circulation Model, *J. Phys. Oceanogr.*, in preparation.
- Thomas, Leif and R. Ferrari, Friction, frontogenesis, frontal instabilities and the stratification of the ocean surface mixed layer, *J. Phys. Oceanogr.*, submitted, 2007.
- Fox-Kemper, B., R. Ferrari, and R. W. Hallberg, Parameterization of Mixed Layer Eddies. I: Theory and Diagnosis, *J. Phys. Oceanogr.*, submitted, 2007.

- Fox-Kemper, B. , and R. Ferrari, Parameterization of Mixed Layer Eddies. II: Prognosis and Impact. *J. Phys. Oceanogr.*, submitted, 2007.
- Danabasoglu G., R. Ferrari and J. C. McWilliams, Sensitivity of an Ocean General Circulation Model to a Parameterization of Near-Surface Eddy Fluxes, *J. Climate*, submitted, 2007.
- Ferrari, R., and J. C. McWilliams, Parameterization of eddy fluxes at the ocean boundaries, *J. Climate*, submitted, 2007.
- Boccaletti G., R. Ferrari, and B. Fox-Kemper, Mixed Layer Instabilities and Restrification, *J. Phys. Oceanogr.*, in press, 2007.
- Ferrari, R., and K. L. Polzin, Temperature and salinity finestructure in NATRE, *J. Phys. Oceanogr.*, **35**, 1437–1454, 2005.
- Boccaletti G., R. Ferrari, D. Ferreira, A. Adcroft, and J. Marshall, The vertical structure of the oceanic heat transport, *Geophys. Res. Lett.*, **32**, L10603, 1-4, 2005.
- Jochum M., R. Murtugudde, R. Ferrari, and P. Rizzoli, The impact of horizontal resolution on the equatorial mixed layer heat budget in ocean general circulation models, *J. Climate*, **18**, 841–851, 2005 .
- Plumb, R., and R. Ferrari, Transformed Eulerian-mean theory. I: Non-quasigeostrophic theory for eddies on a zonal mean flow, *J. Phys. Oceanogr.*, **35**, 165–174, 2005.
- Ferrari, R., and G. Boccaletti, *Oceanography*, **17**, 12–21, 2004.
- Wunsch, C., and R. Ferrari, Vertical Mixing, Energy, and the General Circulation of the Oceans, *Ann. Rev. Fluid Mech.*, **36**, 281–314, 2004.
- Polzin, K. L., and R. Ferrari, Lateral dispersion in NATRE, *J. Phys. Oceanogr.*, **34**, 247–257, 2004.
- Ferrari, R. and F. Paparella, Thermohaline alignment and compensation in the ocean mixed layer, *J. Phys. Oceanogr.*, **33**, 2214–2223, 2003.
- Fox-Kemper, B., R. Ferrari, and J. Pedlosky, A Note on Determination of Rotational and Divergent Eddy Fluxes, *J. Phys. Oceanogr.*, **16**, 875–881, 2003.
- Ferrari, R., and P. Cessi, Seasonal synchronization in a chaotic ocean–atmosphere model, *J. Climate*, **33**, 478–483, 2003.
- Ferrari, R., A. J. Manfroi, and W. R. Young, Weakly and strongly self-similar diffusion, *Physica D*, **154**, 111–137, 2001.
- Ferrari, R., and Rudnick, D.L., Thermohaline structure of the upper ocean, *J. Geophys. Res.*, **105**, 16857–16883, 2000.
- Rudnick, D.L., and R. Ferrari, Compensation of horizontal temperature and salinity gradients in the ocean mixed layer, *Science*, **283**, 526–529, 1999.
- Ferrari, R., and W. R. Young, On the development of thermohaline correlations as a result of nonlinear diffusive parameterizations, *J. Mar. Res.*, **55**, 1069–1101, 1997.

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### Non-Refereed Journals

- Bretherton, C. S., R. Ferrari, and S. Legg, Climate Process Teams: A progress report, *U.S. CLIVAR Variations*, **4**, No. 1, 2006.

- Ferrari, R., Ocean Mixing, BASC report entitled "Improving the Scientific Foundation for Atmosphere-Land-Ocean Simulations: Report of a Workshop", National Academy of Sciences, 2005.
- Bretherton, C. S., R. Ferrari, and S. Legg, Climate Process Teams: A new approach to improving climate models, *U.S. CLIVAR Variations*, **2**, No. 1, 1–6, 2004.
- Ferrari, R., and A. Plumb, Mesoscale eddy fluxes at the boundaries in ocean circulation models. Proceedings of the 'Aha Huliko'a Winter Workshop, Honolulu, Hawaii, 2003.
- Ferrari, R., D.L. Rudnick, W. R. Young, and F. Paparella, The temperature-salinity relationship of the surface mixed-layer. Proceedings of the 'Aha Huliko'a Winter Workshop, Honolulu, Hawaii, 2001.
- Ferrari, R., Dispersion of active and passive scalars in the upper ocean. Doctoral Dissertation. Scripps institution of Oceanography, La Jolla, 2000.
- Ferrari, R., The temperature-salinity relationship in the mixed layer. Proceedings of the Geophysical Fluid Dynamics Program, 1999.
- Ferrari, R., Distribuzioni di temperatura e salinitá negli strati piú superficiali degli oceani. Doctoral dissertation. Politecnico di Torino, 1999.
- Ferrari, R., Integrazione numerica di equazioni solitoniche multidimensionali. Master thesis. Università di Torino, 1994.