Ryan Patrick Abernathey

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Contact

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Education

- *[Sept. 2006–Feb. 2012]* – **Ph.D., Climate Physics and Chemistry**, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
  thesis: Mixing by Ocean Eddies, *advisor:* John Marshall
- *[Sept. 2000–May 2004]* – **B.A., Physics**, Middlebury College, Middlebury, Vermont, USA
  thesis: Phase Dynamics and Synchronization of the Van der Pol Oscillator, *advisor:* Jeffrey Dunham

Appointments

- *[July 2013–present]* – **Assistant Professor**, Columbia University / Lamont Doherty Earth Observatory, New York, New York, USA
- *[June 2012–July 2013]* – **Postdoctoral Scholar**, Scripps Institution of Oceanography, La Jolla, California, USA
- *[Feb. 2012–June 2012]* – **Postdoctoral Scholar**, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
- *[Sept. 2006–Feb. 2012]* – **Graduate Research Assistant / Ph.D. Student**, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA

Awards

- *[Feb. 2016]* – Alfred P. Sloan Research Fellow in Ocean Sciences
- *[Feb. 2016]* – NSF CAREER Award
- *[Apr. 2014]* – NASA New Investigator Early Career Award
- *[June 2011]* – Student Award Winner, AMS Conference on Atmospheric and Oceanic Fluid Dynamics
- *[Dec. 2010]* – Outstanding Student Presentation, AGU Fall Meeting

Publications

Submitted

1. Abernathey, R., I. Cerovečki, P. R. Holland, E. Newsom, M. Mazloff, and L. D. Talley, 2016: Southern Ocean Water Mass Transformation Driven by Sea Ice. | PDF
2. Sinha, A., and R. Abernathey, 2016: Timescales of Southern Ocean Eddy Equilibration. | PDF

Published / In Press

1. Abernathey, R., J. Marshall, E. Shuckburgh, and M. Mazloff, 2010: Enhancement of Mesoscale Eddy Stirring at Steering Levels in the Southern Ocean. *J. Phys. Oceanogr.*, **40**, 170–185, doi:10.1175/2009JPO4201.1. → online | PDF
2. Abernathey, R., J. Marshall, and D. Ferreira, 2011: The Dependence of Southern Ocean Meridional Overturning on Wind Stress. *J. Phys. Oceanogr.*, **41**, 2261–2278, doi:10.1175/JPO-D-11-023.1. → online | PDF
3. Hill, C., D. Ferreira, J.-M. Campin, J. Marshall, R. Abernathey, and N. Barrier, 2012: Controlling Spurious Diapycnal Mixing in Eddy-Resolving Height-Coordinate Ocean Models: Insights from Virtual Deliberate Tracer Release Experiments. *Ocean Modelling*, **45-46**, 14–26, doi:10.1016/j.ocemod.2011.12.001. → online | PDF
4. Abernathey, R., D. Ferreira, and A. Klocker, 2013: Diagnostics of isopycnal mixing in a circumpolar channel. *Ocean Modelling*, **72**, 1–16, doi:10.1016/j.ocemod.2013.07.004. → online | PDF
5. Abernathey, R., and J. C. Marshall, 2013: Global surface eddy diffusivities derived from satellite altimetry. *J. Geophys. Res.*, **118**, 901–916, doi:10.1002/jgrc.20066. → online | PDF
6. Abernathey, R. P., and P. Cessi, 2014: Topographic Enhancement of Eddy Efficiency in Baroclinic Equilibration. *J. Phys. Oceanogr.*, **44**, 2107–2126, doi:10.1175/JPO-D-14-0014.1. → online | PDF
7. Klocker, A., and R. Abernathey, 2014: Global Patterns of Mesoscale Eddy Properties and Diffusivities. *J. Phys. Oceanogr.*, **44**, 1030–1047, doi:10.1175/JPO-D-13-0159.1. → online | PDF
8. Gnanadesikan, A., R. Abernathey, and M.-A. Pradal, 2014: Exploring the isopycnal mixing and helium-heat paradoxes in a suite of Earth System Models. *Ocean Science Discussions*, **11**, 2533–2567, doi:10.5194/osd-11-2533-201. → online | PDF
9. Solomon, A., L. M. Polvani, K. L. Smith, and R. Abernathey, 2015: The impact of ozone depleting substances on the circulation, temperature and salinity of the Southern Ocean: An attribution study with CESM1 (WACCM). *Geophysical Research Letters*, **42**, 5547—5555, doi:10.1002/2015GL064744. → online | PDF
10. Abernathey, R., and D. Ferreira, 2015: Southern Ocean isopycnal mixing and ventilation changes driven by winds. *Geophysical Research Letters*, **42**, 10,357–310,365, doi:10.1002/2015GL066238. → online | PDF
11. Abernathey, R. P., and C. Wortham, 2015: Phase speed cross spectra of eddy heat fluxes in the Pacific. *J. Phys. Oceanogr.*, **45**, 1285–1301, doi:10.1175/JPO-D-14-0160.1. → online | PDF
12. Gnanadesikan, A., M.-A. Pradal, and R. Abernathey, 2015: Isopycnal mixing by mesoscale eddies significantly impacts oceanic anthropogenic carbon uptake. *Geophysical Research Letters*, **42**, 4249–4255, doi:10.1002/2015GL064100. → online | PDF
13. Bishop, S. P., P. R. Gent, F. O. Bryan, A. F. Thompson, M. C. Long, and R. P. Abernathey, 2016: Southern Ocean Overturning Compensation in an Eddy-Resolving Climate Simulation. *Journal of Climate*, | PDF
14. Newsom, E., C. Bitz, F. Bryan, R. P. Abernathey, and P. Gent, 2016: Southern Ocean Deep Circulation and Heat Uptake in a High-Resolution Climate Model. *Journal of Climate*, | PDF
15. Wang, L., M. F. Jansen, and R. P. Abernathey, 2016: Eddy phase speeds in a two-layer model of quasigeostrophic baroclinic turbulence with applications to ocean observations. *Journal of Physical Oceanography*, | PDF

Teaching

- Introduction to Physical Oceanography – Physical properties of seawater, ocean water masses and their distribution, sea-air interaction, ocean general circulation, mixing processes. (Fall 2013, Fall 2014, Fall 2015)
- Geophysical Fluid Dynamics – Fundamental concepts in the dynamics of rotating stratified flows. Geostrophic and hydrostatic balances, potential vorticity, f and beta plane approximations, gravity

and Rossby waves, geostrophic adjustment and quasigeostrophy, baroclinic and barotropic instabilities. (Spring 2014, Spring 2016)

- Python for Scientific Computing – For the past two years, I have taught an informal introduction to python, designed to take a novice from zero to fully functional in about eight hours. Topics include core python language, IPython notebooks, numpy, matplotlib, Basemap, pandas, and xray. (September 2014, August 2015)

Software

- xgcm – A python package for the analysis of ocean general circulation model output. Builds on the fantastic xray and dask projets to provide parallel, out-of-core scalability.
- pyqg – A python quasigeostrophic model for turbulence simulations. Well documented and easy to use—ideal for students, but fast enough for real research.
- floater – Python package for turning MITgcm model Lagrangian float output data into PyTables indexed HDF5 files.
- MITgcmdata – Legacy package for working with MITgcm model output data. I am in the process of replacing this with xgcm.

Presentations

Invited

- *[Jan. 2016]* – Southern Ocean Water Mass Transformation Driven by Sea Ice, Workshop on thermodynamic analysis for atmospheric and oceanic flows, NYU Abu Dhabi, Abu Dhabi, UAE
- *[Jan. 2016]* – Southern Ocean Water Mass Transformation Driven by Sea Ice, Southern Ocean Carbon and Climate Observations and Modeling Webinar
- *[Sept. 2015]* – Identifying Lagrangian Coherent Structures on a Basin Scale using MITgcm and PyTables, Workshop on the Future of Lagrangian Ocean Modeling, Imperial College, London, UK
- *[Feb. 2015]* – The Upwelling Branch of the Southern Ocean Overturning Circulation, Southern Ocean Dynamics and Biogeochemistry Workshop, California Institute of Technology, Pasadena, CA
- *[Dec. 2014]* – The Phase Speed Signature of Mesoscale Eddy Fluxes in the Pacific, Harvard University, Cambridge, MA
- *[July 2014]* – The Phase Speed Signature of Mesoscale Eddy Fluxes in the Pacific, Woods Hole Oceanographic Institution, Woods Hole, MA
- *[July 2014]* – The Phase Speed Signature of Mesoscale Eddy Fluxes in the Pacific, Geophysical Fluid Dynamics Laboratory, Princeton, NJ
- *[May 2014]* – Topographic Enhancement of Eddy Efficiency in Baroclinic Equilibration, Johns Hopkins University, Baltimore, MD
- *[May 2014]* – Topographic Enhancement of Eddy Efficiency in Baroclinic Equilibration, Johns Hopkins University, Baltimore, MD
- *[Apr. 2014]* – Topographic Enhancement of Eddy Efficiency in Baroclinic Equilibration, Courant Institute at New York University, New York, NY
- *[March 2014]* – Topographic Enhancement of Eddy Efficiency in Baroclinic Equilibration, University of Rhode Island, Narragansett, RI

- *[April 2013]* – Mixing By Ocean Eddies, National Center for Atmospheric Research, Boulder, CO
- *[March 2013]* – Mixing By Ocean Eddies, Scripps Institution of Oceanography, La Jolla, CA
- *[Feb. 2013]* – Equilibration of Circumpolar Currents with and without Topography, California Institute of Technology, Pasadena, CA
- *[Oct. 2012]* – Mixing By Ocean Eddies, Physical Oceanography Dissertation Symposium, Lihue, Kaua'i, HI
- *[April 2012]* – Mixing By Ocean Eddies, Lamont Doherty Earth Observatory, Palisades, NY
- *[March 2012]* – Mixing By Ocean Eddies, University of Chicago, Chicago, IL

Conference

- *[Oct. 2015]* – Isopycnal Mixing and Ventillation Controlled by Winds, CLIVAR Workshop on Translating Process Understanding to Improve Climate Models, Princeton, NJ
- *[June 2015]* – Phase Speed Spectra of Ocean Mesoscale Eddies, AMS Conference on Atmosphere Ocean Fluid Dynamics, Minneapolis, MN
- *[Dec. 2014]* – Surface Water Mass Transformation by Mesoscale Eddy Stirring, AGU Fall Meeting, San Francisco, CA
- *[Feb. 2014]* – Evaluating Theories for Mesoscale Eddy Diffusivity Using Satellite Observations, AGU Ocean Sciences Meeting, Honolulu, HI
- *[June 2013]* – Macroturbulent Equilibration of Circumpolar Currents with and without Topography, Ocean Turbulence Conference, Center for Nonlinear Science, Santa Fe, NM
- *[Feb. 2013]* – Equilibration of Circumpolar Currents with and without Topography, Southern Ocean Workshop, Massachusetts Institute of Technology, Cambridge, MA
- *[Dec. 2012]* – Equilibration of Circumpolar Currents with and without Topography, AGU Fall Meeting, San Francisco, CA
- *[April 2012]* – , European Geosciences Union General Assembly, Vienna, Austria
- *[Feb. 2012]* – , AGU Ocean Sciences Meeting, Salt Lake City, UT
- *[June 2011]* – , AMS Conference on Atmospheric and Oceanic Fluid Dynamics, Spokane, WA
- *[Oct. 2011]* – , Graduate Climate Conference, Woods Hole Oceanographic Institution, Woods Hole, MA
- *[Dec. 2010]* – , AGU Fall Meeting, San Francisco, CA
- *[Feb. 2010]* – , AGU Ocean Sciences Meeting, Portland, OR
- *[June 2009]* – , AMS Conference on Atmospheric and Oceanic Fluid Dynamics, Stowe, VT

Service

Community

- Faculty Member, 2014 Geophysical Fluid Dynamics Summer School, Woods Hole Oceanographic Institution, Woods Hole, MA
- Session Convener, The Southern Ocean and Its Role in the Climate System; Observations and Modeling of Physical and Biogeochemical Processes, 2014 Ocean Sciences Meeting, Honolulu, HI

- Member, American Geophysical Union
- Member, European Geophysical Union
- Member, American Meteorological Society
- Reviewer for Journal of Physical Oceanography
- Reviewer for Journal of Geophysical Research Oceans
- Reviewer for Geophysical Research Letters
- Reviewer for Ocean Modelling
- Reviewer for Nature Communications
- Reviewer for National Science Foundation

Univeristy

- DEES Curriculum Committee (2016)
- DEES Broad Search Committee (2016)
- DEES Cryosphere Search Committee (2015)
- Yeti High Performance Computing Executive Committe (2015-2016)
- LDEO Real Time Earth Initiative Committee
- Center for Climate and Life Board Member