

CAITLIN WHALEN

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RESEARCH INTERESTS

Small-scale oceanic mixing processes that impact global ocean dynamics and climate, diapycnal mixing, submesoscale dynamics, air-sea interactions, internal waves, near-inertial waves, mesoscale-internal wave interactions, tides, microstructure observations of turbulence, mixing parameterizations.

POSITIONS

Senior Oceanographer <i>Applied Physics Laboratory, U. of Washington</i>	<i>Aug. 2018 - present</i>
Affiliate Assistant Professor <i>School of Oceanography, U. of Washington</i>	<i>Mar. 2020 - present</i>

EDUCATION + TRAINING

Applied Physics Laboratory, U. of Washington, Postdoctoral Research Associate <i>Mentors K. Drushka & P. Gaube</i>	<i>2016-2018</i>
Scripps Institution of Oceanography, PhD. in Physical Oceanography <i>Advisors L. Talley & J. MacKinnon</i>	<i>Oct. 2015</i>
Reed College, B.A. in Physics	<i>May 2008</i>

AWARDS

Applied Physics Laboratory SEEDs Postdoctoral Fellowship	<i>2016-2018</i>
Frieman Prize for Excellence in Graduate Student Research (<i>Awarded by Scripps</i>)	<i>2013</i>

PUBLICATIONS

[S] = student advisee work, C. B. Whalen is the lead advisor.

[17] Trossman D. S., **C. B. Whalen**...and R. Kovach, 2020. *Tracer and observationally-derived constraints on horizontal and diapycnal diffusivities in ocean models.* (J. Adv. Model. Earth Sy., in review)

[16] Thomas, L. N....**C. B. Whalen**...and V. Hormann, 2020. *Direct observations of near-inertial wave ζ -refraction in a dipole vortex.* (Geophys. Res. Lett., in review)

[15] Frajka-Williams, E., A. Brearley, J. Nash, **C. B. Whalen**, 2020. 'New technological frontiers in ocean mixing,' in M. Meredith and A. Naveira Garabato (ed.) *Ocean Mixing*, (in review)

[14] Zhang, H. J., **C. B. Whalen**, N. Kumar, and S. G. Purkey, 2020. *Abyssal Stratification Change in the Southwest Pacific Basin.* (Geophys. Res. Lett., in revision) [S]

- [13] Cimoli, L...**C. B. Whalen**...and L. D. Talley, 2020. *Significant cross-density mixing within the Atlantic Overturning Circulation*. (Nature Comm., in revision)
- [12] **Whalen, C. B.**, C. de Lavergne,...and K. Sheen, 2020. *Internal wave driven mixing: governing processes and consequences for climate* (Nat. Rev. Earth Environ.)
- [11] de Lavergne, C...**C. B. Whalen**... and T. Hibiya, 2020. *A parameterization of local and remote tidal mixing*. J. Adv. Model. Earth Sy. 12, e2020MS002065.
- [10] IPCC Special Report on Oceans and Cryosphere in a Changing Climate, 2019. Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities. (**C. B. Whalen**, contributing author)
- [9] **Whalen, C. B.**, J. A. MacKinnon, and L. D. Talley, 2018. *Large-Scale Impacts of the Mesoscale Environment on Mixing from Wind-Driven Internal Waves*. Nature Geo. 11, 842-847.
- [8] MacKinnon J. A., Z. Zhao, **C. B. Whalen**...and M. H. Alford, 2017. *Climate Process Team on Internal-Wave Driven Ocean Mixing* Bull. Amer. Meteor. Soc., 98(11), 2429-2454.
- [7] MacKinnon J. A.,...**C. B. Whalen**...and G. L. Wagner, 2016. *A Tale of Two Spicy Seas*. Oceanography, 29(2), 50-61.
- [6] Wijesekera, H. W.,...and **C. B. Whalen**, 2016. *ASIRI: An Ocean-Atmosphere Initiative for Bay of Bengal*. Bull. Amer. Meteor. Soc., 97(10), 1859-1884.
- [5] Salehipour, H., W. R. Peltier, **C. B. Whalen**, J. A. MacKinnon, 2016. *A New Characterization of the Turbulent Diapycnal Diffusivities of Mass and Momentum in the Ocean*. Geophys. Res. Lett. 43(7), 3370-3379.
- [4] Buijsman, M. C.,...**C. B. Whalen** and Z. Zhao, 2016. *Impact of Parameterized Internal Wave Drag on the Semidiurnal Energy Balance in a Global Ocean Circulation Model*. J. Phys. Oceanogr., 46, 1399-1419.
- [3] **Whalen, C. B.**, J. A. MacKinnon, L. D. Talley and A. F. Waterhouse, 2015. *Estimating the Mean Diapycnal Mixing Using a Finescale Strain Parameterization*. J. Phys. Oceanogr., 45, 1174-1188.
- [2] Waterhouse, A. F.,...**C. B. Whalen** and C. M. Lee, 2014. *Global Patterns of Diapycnal Mixing from Measurements of the Turbulent Dissipation Rate*. J. Phys. Oceanogr., 44, 1854-1872.
- [1] **Whalen, C. B.**, L. D. Talley and J. A. MacKinnon, 2012. *Spatial and temporal variability of global ocean mixing inferred from Argo profiles*. Geophys. Res. Lett., 39 (18).

FUNDING

Current:

- Determining the Global Geography, Seasonality, and Impact of Submesoscale Density Fronts** 2018-2021
 NASA PO: \$453,218. PI Whalen, Co-PIs Drushka and Gaube
- Profiling Float Measurements of Near-Inertial Waves and Turbulence** 2018-2023
 ONR NISKINE DRI: \$1,559,839. PI Lien, Co-PIs Whalen, Kunze, and Girton
- Exploring Mixing in the Thermocline in the Context of Satellite Winds and Currents** 2019-2022
 NASA PO: \$431,974. PI Whalen and Co-PI Whitt (NCAR)
- Changes in Internal Wave Driven Diapycnal Mixing** 2019-2022
 NSF PO: \$292,732. PI Whalen

Pending:

Evaluating mechanisms for enhanced mixing below tropical instability waves 2021-2026
NSF PO: \$3,680,365 total. PI Whalen (\$1,088,533) Co-PIs Waterhouse/Voet (Scripps), Moum/Shroyer (OSU)

Past:

Acquisition of EM-APEX Floats for ONR DRI Experiment - NISKINE 2019
ONR DURIP: \$319,860. PI Lien, Co-PIs Whalen, Kunze, and Girton

Observing the Changing Abyssal Ocean 2019-2020
U. of Washington Royalty Research Fund: \$39,697. PI Whalen

Eddy vs. Internal Waves: an Untold Story 2013
U. of California Ship Funds: 10 days of science aboard the R/V Revelle, PI Whalen

Interpreting Regional and Temporal Variability in Global Diapycnal Mixing Inferred from Argo Profiles 2013-2016
NSF PO \$390,942. PIs MacKinnon and Talley. PhD thesis proposal of Whalen

MENTORING

Helen Zhang, post-bac trainee, now a graduate student at Scripps Summer 2018-Fall 2020

TEACHING EXPERIENCE AND TRAINING

Guest Lecturer 2019
Introduction to Fluid Mechanics, Civil and Environmental Engineering, U. of Washington

Scientific Teaching Fellow 2017
Summer Institute for Scientific Teaching, 4 day workshop, Eugene OR

Communicating Science to General Audiences Class 2011
Scripps Institution of Oceanography, quarter-long class, San Diego CA

Laboratory Teaching Assistant for General Physics I 2007 - 2008
Reed College, Physics Dept., Portland OR

SCIENTIFIC COMMUNITY SERVICE

Applied Physics Laboratory Early Career Principal Investigator Group, Co-Leader 2020

Ocean Sciences Session, Chair 2020

Ocean Sciences Session, Co-chair 2018

NASA Panelist 2016

Ocean Sciences 2014 Planning Committee 2012-2014

Ocean Sciences Session, Co-chair 2014

Scripps Institution of Oceanography Department Seminars, Co-organizer 2013

Reviewer: GRL, Nature, JPO, JGR, DSR, Nature Com., NSF

DIVERSITY, EQUITY, AND INCLUSION SERVICE

Diversity Equity and Inclusion Working Group, Member 2020-
Applied Physics Laboratory, University of Washington

Anti-discrimination Postdoc Union Work Group, Member <i>Contributed to the union bargaining agreement, postdoc equity survey, public engagement</i>	2018-2019
Mentoring Physical Oceanography Women to Increase Retention (MPOWIR), Panelist <i>Ocean Sciences Meeting</i>	2016
International Meeting of Students in Physical Oceanography, Lead Organizer <i>A meeting primarily of students from the USA and Mexico</i>	2012

INVITED TALKS

Duke University, Durham NC <i>Small scale turbulence and mixing with global impacts</i>	June 2020
Australian National University, Canberra Australia <i>Internal wave driven mixing in the ocean: governing processes and consequences for climate</i>	Oct. 2019
McGill University, Montreal Canada <i>Tiny physics with giant implications: internal wave driven mixing in the global ocean</i>	Sep. 2018
Ocean Mixing Gordon Research Conference, Andover NH <i>Global geography and seasonality of mixing from internal waves</i>	June 2018
NASA Coupled Ocean Surface Variables Workshop, Eatonville WA <i>Ocean mixing from space?</i>	Mar. 2018
Reed College, Portland OR <i>A global view of mixing from oceanic internal waves</i>	Oct. 2017
Physical Oceanography Dissertation Symposium, Honolulu HI <i>Illuminating spatial and temporal patterns of ocean mixing as inferred from Argo profiling floats</i>	Oct. 2016
Applied Physics Laboratory, University of Washington, Seattle WA <i>A global perspective on the role of wind and mesoscale eddies in internal wave driven mixing</i>	Aug. 2015

SELECTED TALKS

Ocean Sciences, San Diego CA <i>Global geography of submesoscale density fronts</i>	Feb. 2020
WHOI, Woods Hole MA <i>How is the fate of wind-driven internal waves altered by an energetic mesoscale?</i>	May 2018
BIRS Modeling Imbalance in the Atmosphere and Ocean, Banff Canada <i>Observations of mixing from wind-driven internal waves in an energetic mesoscale</i>	Feb. 2018
Ocean Sciences, Portland OR <i>Large-scale impacts of the mesoscale environment on mixing from wind-driven internal waves</i>	Feb. 2018
Program on Climate Change Spring Symposium, Seattle WA <i>Ocean internal wave driven mixing from a climate perspective</i>	April 2017
University of Washington, Seattle WA <i>Argo profiling float inferred internal-wave driven mixing in an energetic mesoscale</i>	Nov. 2016

Ocean Sciences Meeting, New Orleans LA <i>The role of the wind and mesoscale eddies in internal wave driven mixing at midlatitudes</i>	Feb. 2016
University of Buenos Aires, Buenos Aires Argentina <i>Illuminating spatial and temporal patterns of ocean mixing as inferred from Argo profiling floats</i>	Dec. 2015
Oregon State University, Corvallis OR <i>From density profiles to diapycnal mixing estimates: applying a finescale strain parameterization to Argo profiles</i>	Feb. 2015
WHOI, Woods Hole MA <i>Using Argo profiles to infer diapycnal mixing in the global ocean</i>	Nov. 2014
University of Washington, Seattle WA <i>Inferring diapycnal mixing in the global ocean using Argo profiles</i>	Oct. 2014
Scripps Student Symposium, San Diego CA <i>Global patterns in small-scale turbulent mixing below the ocean's surface</i>	Sep. 2014
Ocean Sciences Meeting, Honolulu HI <i>Two observational perspectives on eddies, internal waves, and turbulent diapycnal mixing</i>	Feb. 2014
Oregon State University, Corvallis OR <i>A global view of small-scale turbulent mixing</i>	July 2013
International Meeting of Students in Physical Oceanography, San Diego, CA <i>Patterns of turbulent mixing gleaned from Argo profiles</i>	Sep. 2012
International Meeting of Students in Physical Oceanography, Ensenada Mexico <i>A global view of small-scale turbulent mixing</i>	Sept. 2011

SEAGOING EXPERIENCE

Near Inertial Shear and Kinetic Energy in the North Atlantic experiment (NISKINe DRI), ONR <i>PI, EM-APEX floats, North Atlantic, R/V Armstrong, 25 days</i>	2019
Pathways of Circumpolar Deep Water to West Antarctica, NSF <i>EM-APEX floats, Southern Ocean, R/V Palmer, 28 days</i>	2016-2017
Salinity Processes in the Upper Ocean Regional Study 2 (SPURS 2), NASA <i>Seagliders and Mixed Layer Float, Central Tropical Pacific, R/V Thompson, 42 days</i>	2016
Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR <i>Data Watchstander, Bay of Bengal, R/V Revelle, 12 days</i>	2014
Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR <i>UCTD, Bowchain Vertical Microstructure Profiler, Bay of Bengal, R/V Revelle, 18 days</i>	2013
EDDYMIX, UC Ship Funds <i>Chief Scientist, Western Subtropical Pacific, R/V Revelle, 15 days</i>	2013
GALAPMIX, UC Ship Funds <i>Wire-Walking profilers, CTD Watchstander, Eastern Tropical Pacific, R/V Melville, 17 days</i>	2012
EXITS, NSF <i>CTD Watchstander, Central Tropical Pacific, R/V Thompson, 31 days</i>	2010
Santa Barbara Basin, UC Ship Funds <i>Education and Outreach, California Coast, R/V Melville, 9 days</i>	2010

CLIVAR, NSF
CTD Watchstander, Indian Ocean, R/V Revelle, 55 days

2009

OTHER RESEARCH EXPERIENCE

MPOWIR Summer Internship: Ocean Modeling with the MITgcm *Summer 2011*
NOAA Geophysical Fluid Dynamics Laboratory, Princeton NJ (Advisor Sonya Legg)

Undergraduate Research: Changes in Indian Ocean Temperature and Salinity *Mar. - May 2009*
CLIVAR Research Cruise, Indian Ocean (Advisor Gregory Johnson)

Undergraduate Research: Deep Western Boundary Current Tank Experiments *Summer 2007*
U. of Washington, Seattle WA (Advisor Peter Rhines)

OUTREACH

Artist-Scientist Collaborations

Individual and collaborative efforts with artists to create works of art incorporating ideas in ocean science. Work has been shown in San Diego and Seattle. Provided opportunities for artists to produce work that has been shown internationally.

Outreach Volunteer

Educating the general public about oceanography through hands-on experiences at the Birch Aquarium and Pacific Science Center; participating in Reddit 'Ask Me Anything', coordinating social media at sea, and speaking with the local news and documentary filmmakers.