

# 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, observations and parameterizations of turbulence, climate change.

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## POSITIONS

<b>Principal Oceanographer</b> <i>Applied Physics Laboratory, U. of Washington</i>	<i>Nov. 2022 - present</i>
<b>Affiliate Assistant Professor</b> <i>School of Oceanography, U. of Washington</i>	<i>Mar. 2020 - present</i>
<b>Senior Oceanographer</b> <i>Applied Physics Laboratory, U. of Washington</i>	<i>Aug. 2018 - Oct. 2022</i>

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## EDUCATION + TRAINING

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

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## AWARDS

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

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## PUBLICATIONS

[S] = student advisee work

[22] Cimoli, L...**C. B. Whalen**...and L. D. Talley, 2022. *Significance of diapycnal mixing within the Atlantic Meridional Overturning Circulation*. (AGU Advances, in press)

[21] Waterhouse, A...**C. B. Whalen**...and J. M. Hummon, 2022. *Global Observations of Rotary-With-Depth Shear Spectra*. J. Phys. Oceanogr., 52(12), 3241-3258.

[20] Trossman D. S., **C. B. Whalen**...and P. Heimbach, 2022. *Tracer and observationally-derived constraints on horizontal and diapycnal diffusivities in an ocean state estimate*. Ocean Science Discussions, 1-40.

- [19] Johnson, G. C., **C. B. Whalen**, S. G. Purkey, and N. Zilberman, 2022. *Serendipitous Internal Wave Signals in Deep Argo Data*. Geophys. Res. Lett., 49, e2022GL097900.
- [18] Frajka-Williams, E., A. Brearley, J. Nash, **C. B. Whalen**, 2022. 'New technological frontiers in ocean mixing,' in M. Meredith and A. Naveira Garabato (ed.) *Ocean Mixing*, 345-361.
- [17] Lele, R., S. G. Purkey,...**C. B. Whalen**,... and L. D. Talley, 2021. *Abyssal Heat Budget in the South West Pacific Basin*. J. Phys. Oceanogr., 51 (11), 3317-3333.
- [16] Zhang, H. J., **C. B. Whalen**, N. Kumar, and S. G. Purkey, 2021. *Decreased Stratification in the Abyssal Southwest Pacific Basin and Implications for the Energy Budget*. Geophys. Res. Lett., 48, e2021GL094322. [S]
- [15] Katsumata, K., L. D. Talley, T. A. Capuano, **C. B. Whalen**, 2021. *Spatial and temporal variability of diapycnal mixing in the Indian Ocean*. J. Geophys. Res. Oceans, 126, e2021JC017257.
- [14] **Whalen, C. B.**, 2021. *Best Practices for Comparing Ocean Turbulence Measurements Across Spatiotemporal Scales*. J. Atmos. Ocean. Technol., 38(4), 837-841.
- [13] Thomas, L. N....**C. B. Whalen**...and V. Hormann, 2020. *Direct observations of near-inertial wave  $\zeta$ -refraction in a dipole vortex*. Geophys. Res. Lett., 47, e2020GL090375.
- [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. 1, 606-621.
- [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

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**Current:**

<b>Profiling Float Measurements of Near-Inertial Waves and Turbulence</b>	2018-2023
<i>ONR NISKINE DRI: \$1,559,839. PI Lien, Co-PIs Whalen, Kunze, and Girton</i>	
<b>Exploring Mixing in the Thermocline in the Context of Satellite Winds and Currents</b>	2019-2023
<i>NASA PO: \$431,974. PI Whalen and Co-PI Whitt (NASA-Ames)</i>	
<b>Evaluating mechanisms for enhanced mixing below tropical instability waves</b>	2021-2026
<i>NSF PO: \$3,680,365 total. PI Whalen (\$1,088,533) Co-PIs Waterhouse/Voet (Scripps), Moum (OSU)</i>	
<b>Autonomous Profiling EM-Apex Floats for the ARCTERX DRI</b>	2021-2023
<i>ONR DURIP. \$436,639. PI C. Whalen</i>	
<b>Tracking the Evolution of Turbulence within the Submesoscale: Autonomous Profiling Float Observations</b>	2021-2023
<i>ONR ARCTERX DRI. \$690,851. PI C. Whalen</i>	

**Past:**

<b>Determining the Global Geography, Seasonality, and Impact of Submesoscale Density Fronts</b>	2018-2022
<i>NASA PO: \$453,218. PI Whalen, Co-PIs Drushka and Gaube</i>	
<b>Changes in Internal Wave Driven Diapycnal Mixing</b>	2019-2022
<i>NSF PO: \$292,732. PI Whalen</i>	
<b>Acquisition of EM-APEX Floats for ONR DRI Experiment - NISKINE</b>	2019
<i>ONR DURIP: \$319,860. PI Lien, Co-PIs Whalen, Kunze, and Girton</i>	
<b>Observing the Changing Abyssal Ocean</b>	2019-2020
<i>U. of Washington Royalty Research Fund: \$39,697. PI Whalen</i>	
<b>Eddy vs. Internal Waves: an Untold Story</b>	2013
<i>U. of California Ship Funds: 10 days of science aboard the R/V Revelle, PI Whalen</i>	

**MENTORING**

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<b>Sangmin Song</b> , UW graduate student (committee member)	2021-present
<b>Wenjing Dong</b> , NYU graduate student (committee member)	2022
<b>Helen Zhang</b> , post-bac trainee, now a graduate student at Scripps (mentor)	Summer 2018-Fall 2020

**TEACHING EXPERIENCE AND TRAINING**

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<b>Instructor</b>	2022
<i>How to Choose an Appropriate Journal for your Research, 1.5 hr Workshop, U. of Washington</i>	
<b>Guest Lecturer</b>	2019
<i>Introduction to Fluid Mechanics, Civil and Environmental Engineering, U. of Washington</i>	
<b>Scientific Teaching Fellow</b>	2017
<i>Summer Institute for Scientific Teaching, 4 day workshop, Eugene OR</i>	
<b>Communicating Science to General Audiences Class</b>	2011
<i>Scripps Institution of Oceanography, quarter-long class, San Diego CA</i>	

**Laboratory Teaching Assistant for General Physics I**  
*Reed College, Physics Dept., Portland OR*

2007 - 2008

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## SCIENTIFIC COMMUNITY SERVICE

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<b>Editor,</b> Geophysical Research Letters	2021-present
<b>Panelist,</b> NASA and NSF	multiple years
<b>Co-leader,</b> Applied Physics Laboratory Early Career Principal Investigator Group	2020
<b>Chair,</b> Ocean Sciences Session	2020
<b>Co-chair,</b> Ocean Sciences Session	2018
<b>Member,</b> Ocean Sciences Planning Committee	2012-2014
<b>Co-chair,</b> Ocean Sciences Session	2014
<b>Co-organizer,</b> Scripps Institution of Oceanography Department Seminars	2013
<b>Reviewer:</b> GRL, Nature, JPO, JGR, DSR, Nature Com., NSF	ongoing

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## DIVERSITY, EQUITY, AND INCLUSION SERVICE

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<b>Member,</b> Applied Physics Laboratory Diversity, Equity and Inclusion Group	2020-present
<b>Organizer,</b> Undergraduate Mentoring Workshop	2021
<b>Invited Guest,</b> Stanford Women in Fluid Dynamics	2020
<b>Organizer,</b> Beyond Diversity 101 Training at the Applied Physics Laboratory	2020
<b>Member,</b> Anti-discrimination Postdoc Union Work Group	2018-2019
<b>Panelist,</b> Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)	2016
<b>Lead Organizer,</b> International Meeting of Students in Physical Oceanography	2012

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## INVITED TALKS

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<b>American Acoustical Society Annual Meeting, Nashville TN</b> <i>Measuring Ocean Mixing: from Observing Processes to Quantifying Impacts</i>	Dec. 2022
<b>University of Washington, Seattle WA</b> <i>How small-scale density fronts are shaped by their environment throughout the global oceans</i>	Oct. 2022
<b>Scripps, San Diego CA</b> <i>Bridging scales in physical oceanography: from submesoscales to climate scales</i>	April 2022
<b>GFDL, Princeton NJ</b> <i>An overview of internal wave-driven mixing: from processes to climate</i>	Jan. 2022
<b>US CLIVAR Process Study and Model Improvement Panel</b> <i>Evaluating mechanisms for enhanced mixing below tropical instability waves</i>	Nov. 2021
<b>Oregon State University, Corvallis OR</b> <i>Bridging Scales in Physical Oceanography</i>	Sep. 2021
<b>WHOI, Woods Hole MA</b> <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Mar. 2021

<b>Oregon State University, Corvallis OR</b> <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Jan. 2021
<b>Duke University, Durham NC</b> <i>Small scale turbulence and mixing with global impacts</i>	June 2020
<b>Australian National University, Canberra Australia</b> <i>Internal wave driven mixing in the ocean: governing processes and consequences for climate</i>	Oct. 2019
<b>McGill University, Montreal Canada</b> <i>Tiny physics with giant implications: internal wave driven mixing in the global ocean</i>	Sep. 2018
<b>Ocean Mixing Gordon Research Conference, Andover NH</b> <i>Global geography and seasonality of mixing from internal waves</i>	June 2018
<b>NASA Coupled Ocean Surface Variables Workshop, Eatonville WA</b> <i>Ocean mixing from space?</i>	Mar. 2018
<b>Reed College, Portland OR</b> <i>A global view of mixing from oceanic internal waves</i>	Oct. 2017
<b>Physical Oceanography Dissertation Symposium, Honolulu HI</b> <i>Illuminating spatial and temporal patterns of ocean mixing as inferred from Argo profiling floats</i>	Oct. 2016
<b>Applied Physics Laboratory, University of Washington, Seattle WA</b> <i>A global perspective on the role of wind and mesoscale eddies in internal wave driven mixing</i>	Aug. 2015

## SELECTED TALKS

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<b>American Geophysical Meeting</b> <i>Global Scale Variability of Submesoscale Frontal Dynamics</i>	Dec. 2022
<b>Ocean Sciences</b> <i>Distribution and seasonal cycle of submesoscale fronts</i>	Feb. 2022
<b>University of Washington, Seattle WA</b> <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Mar. 2021
<b>Ocean Sciences, San Diego CA</b> <i>Global geography of submesoscale density fronts</i>	Feb. 2020
<b>WHOI, Woods Hole MA</b> <i>How is the fate of wind-driven internal waves altered by an energetic mesoscale?</i>	May 2018
<b>BIRS Modeling Imbalance in the Atmosphere and Ocean, Banff Canada</b> <i>Observations of mixing from wind-driven internal waves in an energetic mesoscale</i>	Feb. 2018
<b>Ocean Sciences, Portland OR</b> <i>Large-scale impacts of the mesoscale environment on mixing from wind-driven internal waves</i>	Feb. 2018
<b>Program on Climate Change Spring Symposium, Seattle WA</b> <i>Ocean internal wave driven mixing from a climate perspective</i>	April 2017
<b>University of Washington, Seattle WA</b> <i>Argo profiling float inferred internal-wave driven mixing in an energetic mesoscale</i>	Nov. 2016

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

## SEAGOING EXPERIENCE

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<b>Island Arc Turbulent Eddy Regional Exchange (ARCTERX DRI), ONR</b> <i>Chief Scientist, Western Subtropical Pacific, R/V Revelle, 12 days</i>	2022
<b>Near Inertial Shear and Kinetic Energy in the North Atlantic experiment (NISKINE DRI), ONR</b> <i>PI, EM-APEX floats, North Atlantic, R/V Armstrong, 25 days</i>	2019
<b>Pathways of Circumpolar Deep Water to West Antarctica, NSF</b> <i>EM-APEX floats, Southern Ocean, R/V Palmer, 28 days</i>	2016-2017
<b>Salinity Processes in the Upper Ocean Regional Study 2 (SPURS 2), NASA</b> <i>Seagliders and Mixed Layer Float, Central Tropical Pacific, R/V Thompson, 42 days</i>	2016
<b>Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR</b> <i>Data Watchstander, Bay of Bengal, R/V Revelle, 12 days</i>	2014
<b>Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR</b> <i>UCTD, Bowchain Vertical Microstructure Profiler, Bay of Bengal, R/V Revelle, 18 days</i>	2013
<b>EDDYMIX, UC Ship Funds</b> <i>Chief Scientist, Western Subtropical Pacific, R/V Revelle, 15 days</i>	2013
<b>GALAPMIX, UC Ship Funds</b> <i>Wire-Walking profilers, CTD Watchstander, Eastern Tropical Pacific, R/V Melville, 17 days</i>	2012
<b>EXITS, NSF</b> <i>CTD Watchstander, Central Tropical Pacific, R/V Thompson, 31 days</i>	2010

**Santa Barbara Basin, UC Ship Funds**

2010

*Education and Outreach, California Coast, R/V Melville, 9 days***CLIVAR, NSF**

2009

*CTD Watchstander, Indian Ocean, R/V Revelle, 55 days***OUTREACH**

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**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.*