

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.

POSITIONS

Oceanographer (Currently Principal) <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

[26] Voet, G., A. F. Waterhouse, A. Savage,... **C. B. Whalen...** J. B. Girton, 2024. *Near-inertial energy variability in a strong mesoscale eddy field in Iceland Basin*. *Oceanography*. (in press)

[25] AGU Editorial Network, 2024. *Challenges Facing Scientific Publishing in the Field of Earth & Space Sciences*. *AGU Advances*, 5, e2024AV001334.

[24] Stokes, I. A., S. M. Kelly, A. J. Lucas, A. F. Waterhouse, **C. B. Whalen...**, L. Centurioni., 2024. *A generalized slab model*. *J. Phys. Oceanogr.* 54(3), 949-965.

[23] Kunze, E., R-C Lien, **C. B. Whalen...**, and M. C. Buijsman, 2023. *Seasonal Variability of Near-Inertial/Semidiurnal Fluctuations and Turbulence in the Sub-Arctic North Atlantic*. *J. Phys. Oceanogr.*, 53(12), 2717-2735.

- [22] Cimoli, L...**C. B. Whalen**...and L. D. Talley, 2023. *Significance of diapycnal mixing within the Atlantic meridional overturning circulation*, AGU Advances, 4, e2022AV000800.
- [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, 18(3), 729-759.
- [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 ζ -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

Current:

- The Evolution of the Winter to Spring Energy Cascade in the ARCTERX Region** 2024-2027
ONR ESS: \$402,591. PI Whalen
- Tracking the Evolution of Turbulence within the Submesoscale: Autonomous Profiling Float Observations** 2021-2025
ONR ARCTERX DRI: \$690,851. PI Whalen
- Autonomous Profiling EM-Apex Floats for the ARCTERX DRI** 2021-2024
ONR DURIP: \$436,639. PI Whalen
- Evaluating mechanisms for enhanced mixing below tropical instability waves** 2021-2026
NSF PO: \$3,680,365: PI Whalen Co-PIs Waterhouse/Voet (Scripps), Moum (OSU)
- Exploring Mixing in the Thermocline in the Context of Satellite Winds and Currents** 2019-2024
NASA PO: \$431,974: PI Whalen and Co-PI Whitt (NASA-Ames)

Past:

- Collaborative Research: RAPID: Pilot observations of enhanced near-bottom equatorial turbulence** 2023-2024
NSF PO: \$197,487. PI Talley (Scripps), Co-PIs Whalen, and Waterhouse/Voet (Scripps)
- 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
- Determining the Global Geography, Seasonality, and Impact of Submesoscale Density Fronts** 2018-2022
NASA PO: \$453,218. PI Whalen, Co-PIs Drushka and Gaube
- Changes in Internal Wave Driven Diapycnal Mixing** 2019-2022
NSF PO: \$292,732. PI Whalen
- 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

MENTORING

- Arachaporn (Waen) Anutaliya**, postdoc (mentor) 2024-present
- Maya Gong**, UW graduate student (advisor) 2023-present
- Song Sangmin**, UW graduate student (committee member) 2021-present

Jood Almokharrak , <i>UW undergraduate student (advisor)</i>	<i>Summer 2024</i>
Wenjing Dong , <i>NYU graduate student (committee member)</i>	<i>2022</i>
Helen Zhang , <i>post-bac trainee (advisor), now a graduate student at Scripps</i>	<i>2018-2020</i>

TEACHING EXPERIENCE AND TRAINING

Co-Instructor <i>Ocean Circulation: Observations, quarter-long graduate level class, U. of Washington</i>	<i>2024</i>
Instructor <i>How to Choose an Appropriate Journal for your Research, 1.5 hr workshop, U. of Washington</i>	<i>2022</i>
Guest Lecturer <i>Introduction to Fluid Mechanics, Civil and Environmental Engineering, U. of Washington</i>	<i>2019</i>
Scientific Teaching Fellow <i>Summer Institute for Scientific Teaching, 4 day workshop, Eugene OR</i>	<i>2017</i>
Communicating Science to General Audiences Class <i>Scripps Institution of Oceanography, quarter-long class, San Diego CA</i>	<i>2011</i>
Laboratory Teaching Assistant for General Physics I <i>Reed College, Physics Dept., Portland OR</i>	<i>2007 - 2008</i>

SCIENTIFIC COMMUNITY SERVICE

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

DIVERSITY, EQUITY, AND INCLUSION SERVICE

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

INVITED TALKS

Theoretical and Practical Perspectives in GFD, Bengaluru India <i>Linking Submesoscale Frontal Dynamics to the Large Scale Background Environment</i>	May 2024
American Acoustical Society Annual Meeting, Nashville TN <i>Measuring Ocean Mixing: from Observing Processes to Quantifying Impacts</i>	Dec. 2022
University of Washington, Seattle WA <i>How small-scale density fronts are shaped by their environment throughout the global oceans</i>	Oct. 2022
Scripps, San Diego CA <i>Bridging scales in physical oceanography: from submesoscales to climate scales</i>	April 2022
GFDL, Princeton NJ <i>An overview of internal wave-driven mixing: from processes to climate</i>	Jan. 2022
US CLIVAR Process Study and Model Improvement Panel <i>Evaluating mechanisms for enhanced mixing below tropical instability waves</i>	Nov. 2021
Oregon State University, Corvallis OR <i>Bridging Scales in Physical Oceanography</i>	Sep. 2021
WHOI, Woods Hole MA <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Mar. 2021
Oregon State University, Corvallis OR <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Jan. 2021
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, New Orleans <i>Global Geography and Governing Dynamics of Submesoscale Density Fronts</i>	Feb. 2024
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American Geophysical Meeting <i>Global Scale Variability of Submesoscale Frontal Dynamics</i>	Dec. 2022
Ocean Sciences <i>Distribution and seasonal cycle of submesoscale fronts</i>	Feb. 2022
University of Washington, Seattle WA <i>Internal wave-driven mixing: governing processes and consequences for climate</i>	Mar. 2021
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

Island Arc Turbulent Eddy Regional Exchange (ARCTERX DRI), ONR <i>Chief Scientist, Western Subtropical Pacific, R/V Revelle, 12 days</i>	2022
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 <i>CTD Watchstander, Indian Ocean, R/V Revelle, 55 days</i>	2009

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.