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) *Aug. 2018 - present*
Applied Physics Laboratory, U. of Washington

Affiliate Assistant Professor *Mar. 2020 - present*
School of Oceanography, U. of Washington

EDUCATION + TRAINING

Applied Physics Laboratory, U. of Washington, Postdoctoral Research Associate *2016-2018*
Mentors K. Drushka & P. Gaube

Scripps Institution of Oceanography, PhD. in Physical Oceanography *Oct. 2015*
Advisors L. Talley & J. MacKinnon

Reed College, B.A. in Physics *May 2008*

AWARDS

Rosenstiel Award in Ocean Science *2026*

NSF CAREER Award *2025-2030*

Applied Physics Laboratory SEEDs Postdoctoral Fellowship *2016-2018*

Frieman Prize for Excellence in Scripps Graduate Student Research *2013*

PUBLICATIONS

[S] = student advisee work

[30] **Whalen, C. B.,** and Kyla Drushka, 2025. *Global distribution and governing dynamics of submesoscale density fronts.* J. Phys. Oceanogr. 55(10), 1831-1845

[29] Alford, M. H.,...**C. B. Whalen**, B. Hall, N Couto, 2025. *Observations of Turbulence Generated by a Near-Inertial Wave Propagating Downward in an Anticyclonic Eddy.* Geophys. Res. Lett. 52(6), e2024GL114070.

[28] Girton, J. B., **C. B. Whalen**, R. C. Lien, E. Kunze, 2024. *Coherent float arrays for near-inertial wave studies.* Oceanography, 37(4), 58-67.

[27] 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. (2024)

[26] Dematteis, G., A. Le Boyer, F. Pollmann...**C. B. Whalen**, Lvov, Y. V, 2024. *Interacting internal waves explain global patterns of interior ocean mixing*. Nature Communications, 15(1), 7468.

[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:

Small Fronts in the Vast Sea - Multiscale Dynamics and Impact of Submesoscale Density Fronts *2025-2030*
NSF CAREER: $913,292. PI Whalen

The Evolution of the Winter to Spring Energy Cascade in the ARCTERX Region *2024-2027*
ONR ESS: $402,591. 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)

Past:

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

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)

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

Zachary Taebel, *Scripps postdoc (mentor)* *2025-present*

Arachaporn (Waen) Anutaliya, *UW postdoc (mentor)* *2024-present*

Maya Gong, *UW graduate student (advisor)* *2023-present*

Song Sangmin, *UW graduate student (committee member)* *2021-present*

Jood Almokharrak, *UW undergraduate student (advisor)* *Summer 2024*

Wenjing Dong, *NYU graduate student (committee member)* *2022*

Helen Zhang, *post-bac trainee (advisor), now a graduate student at Scripps* *2018-2020*

TEACHING EXPERIENCE AND TRAINING

Guest Lecturer *2025*
Waves, graduate level class, U. of Washington

Co-Instructor *2024*
Ocean Circulation: Observations, quarter-long graduate level class, U. of Washington

Instructor *2022*
How to Choose an Appropriate Journal for your Research, 1.5 hr workshop, U. of Washington

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

Vice-Chair, Ocean Mixing Gordon Conference *2026*

Editor, Geophysical Research Letters *2021-2024*

Panelist, NASA and NSF *multiple years*

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

Chair, Ocean Sciences Session *2020*

Co-chair, Ocean Sciences Session *2014, 2018*

Member, Ocean Sciences Planning Committee	*2012-2014*
Co-organizer, Scripps Institution of Oceanography Department Seminars	*2013*
Reviewer: GRL, Nature, JPO, JGR, DSR, Nature Com., NSF	*ongoing*

DIVERSITY, EQUITY, AND INCLUSION SERVICE

Mentor Group Co-leader, Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)	*2026-2028*
Member, Applied Physics Laboratory Diversity, Equity and Inclusion Group	*2020-2025*
Organizer, Undergraduate Mentoring Workshop	*2021*
Invited Guest, Stanford Women in Fluid Dynamics	*2020*
Organizer, Beyond Diversity 101 Training at the Applied Physics Laboratory	*2020*
Member, Anti-discrimination Postdoc Union Work Group	*2018-2019*
Panelist, Mentoring Physical Oceanography Women to Increase Retention (MPOWIR)	*2016*
Lead Organizer, International Meeting of Students in Physical Oceanography	*2012*

INVITED TALKS

Caltech, Pasadena CA *May 2025*
The Global Ocean's Role in Shaping Small Fronts

Theoretical and Practical Perspectives in GFD, Bengaluru India *May 2024*
Linking Submesoscale Frontal Dynamics to the Large Scale Background Environment

American Acoustical Society Annual Meeting, Nashville TN *Dec. 2022*
Measuring Ocean Mixing: from Observing Processes to Quantifying Impacts

University of Washington, Seattle WA *Oct. 2022*
How small-scale density fronts are shaped by their environment throughout the global oceans

Scripps, San Diego CA *April 2022*
Bridging scales in physical oceanography: from submesoscales to climate scales

GFDL, Princeton NJ *Jan. 2022*
An overview of internal wave-driven mixing: from processes to climate

US CLIVAR Process Study and Model Improvement Panel *Nov. 2021*
Evaluating mechanisms for enhanced mixing below tropical instability waves

Oregon State University, Corvallis OR *Sep. 2021*
Bridging Scales in Physical Oceanography

WHOI, Woods Hole MA *Mar. 2021*
Internal wave-driven mixing: governing processes and consequences for climate

Oregon State University, Corvallis OR *Jan. 2021*
Internal wave-driven mixing: governing processes and consequences for climate

Duke University, Durham NC *June 2020*
Small scale turbulence and mixing with global impacts

Australian National University, Canberra Australia *Oct. 2019*
Internal wave driven mixing in the ocean: governing processes and consequences for climate

McGill University, Montreal Canada *Sep. 2018*
Tiny physics with giant implications: internal wave driven mixing in the global ocean

Ocean Mixing Gordon Research Conference, Andover NH *June 2018*
Global geography and seasonality of mixing from internal waves

NASA Coupled Ocean Surface Variables Workshop, Eatonville WA *Mar. 2018*
Ocean mixing from space?

Reed College, Portland OR *Oct. 2017*
A global view of mixing from oceanic internal waves

Physical Oceanography Dissertation Symposium, Honolulu HI *Oct. 2016*
Illuminating spatial and temporal patterns of ocean mixing as inferred from Argo profiling floats

Applied Physics Laboratory, University of Washington, Seattle WA *Aug. 2015*
A global perspective on the role of wind and mesoscale eddies in internal wave driven mixing

SELECTED TALKS

Ocean Sciences, New Orleans *Feb. 2024*
Global Geography and Governing Dynamics of Submesoscale Density Fronts

American Geophysical Meeting *Dec. 2022*
Global Scale Variability of Submesoscale Frontal Dynamics

Ocean Sciences *Feb. 2022*
Distribution and seasonal cycle of submesoscale fronts

University of Washington, Seattle WA *Mar. 2021*
Internal wave-driven mixing: governing processes and consequences for climate

Ocean Sciences, San Diego CA *Feb. 2020*
Global geography of submesoscale density fronts

WHOI, Woods Hole MA *May 2018*
How is the fate of wind-driven internal waves altered by an energetic mesoscale?

BIRS Modeling Imbalance in the Atmosphere and Ocean, Banff Canada *Feb. 2018*
Observations of mixing from wind-driven internal waves in an energetic mesoscale

Ocean Sciences, Portland OR *Feb. 2018*
Large-scale impacts of the mesoscale environment on mixing from wind-driven internal waves

Program on Climate Change Spring Symposium, Seattle WA *April 2017*
Ocean internal wave driven mixing from a climate perspective

University of Washington, Seattle WA *Nov. 2016*
Argo profiling float inferred internal-wave driven mixing in an energetic mesoscale

Ocean Sciences Meeting, New Orleans LA *Feb. 2016*
The role of the wind and mesoscale eddies in internal wave driven mixing at midlatitudes

University of Buenos Aires, Buenos Aires Argentina *Dec. 2015*
Illuminating spatial and temporal patterns of ocean mixing as inferred from Argo profiling floats

Oregon State University, Corvallis OR *Feb. 2015*
From density profiles to diapycnal mixing estimates: applying a finescale strain parameterization to Argo profiles

WHOI, Woods Hole MA *Nov. 2014*
Using Argo profiles to infer diapycnal mixing in the global ocean

University of Washington, Seattle WA *Oct. 2014*
Inferring diapycnal mixing in the global ocean using Argo profiles

Scripps Student Symposium, San Diego CA *Sep. 2014*
Global patterns in small-scale turbulent mixing below the ocean's surface

Ocean Sciences Meeting, Honolulu HI *Feb. 2014*
Two observational perspectives on eddies, internal waves, and turbulent diapycnal mixing

Oregon State University, Corvallis OR *July 2013*
A global view of small-scale turbulent mixing

International Meeting of Students in Physical Oceanography, San Diego, CA *Sep. 2012*
Patterns of turbulent mixing gleaned from Argo profiles

International Meeting of Students in Physical Oceanography, Ensenada Mexico *Sept. 2011*
A global view of small-scale turbulent mixing

SEAGOING EXPERIENCE

Mixing belOw Tropical Instability waVEs (MOTIVE), NSF *2025*
Chief Scientist, Equatorial Pacific, R/V Sikuliaq, 24 days

Island Arc Turbulent Eddy Regional Exchange (ARCTERX DRI), ONR *2025*
PI, EM-APEX floats, Western Subtropical Pacific, R/V Thompson, 25 days

Mixing belOw Tropical Instability waVEs (MOTIVE), NSF *2024*
Chief Scientist, Equatorial Pacific, R/V Sikuliaq, 34 days

Island Arc Turbulent Eddy Regional Exchange (ARCTERX DRI), ONR *2022*
Chief Scientist, Western Subtropical Pacific, R/V Revelle, 12 days

Near Inertial Shear and Kinetic Energy in the North Atlantic experiment (NISKINe DRI), ONR *2019*
PI, EM-APEX floats, North Atlantic, R/V Armstrong, 25 days

Pathways of Circumpolar Deep Water to West Antarctica, NSF *2016-2017*
EM-APEX floats, Southern Ocean, R/V Palmer, 28 days

Salinity Processes in the Upper Ocean Regional Study 2 (SPURS 2), NASA *2016*
Seagliders and Mixed Layer Float, Central Tropical Pacific, R/V Thompson, 42 days

Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR *2014*
Data Watchstander, Bay of Bengal, R/V Revelle, 12 days

Air-Sea Interactions in the Northern Indian Ocean (ASIRI DRI), ONR *2013*
UCTD, Bowchain Vertical Microstructure Profiler, Bay of Bengal, R/V Revelle, 18 days

EDDYMIX, UC Ship Funds *2013*
Chief Scientist, Western Subtropical Pacific, R/V Revelle, 15 days

GALAPMIX, UC Ship Funds *2012*
Wire-Walking profilers, CTD Watchstander, Eastern Tropical Pacific, R/V Melville, 17 days

EXITS, NSF *2010*
CTD Watchstander, Central Tropical Pacific, R/V Thompson, 31 days

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

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.