

CURRICULUM VITAE

Brian D. Dushaw
Born 1961, San Tomé, Venezuela (U.S. Citizen)

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Professional Preparation

Occidental College, Los Angeles	Physics	A.B., 1983
University of California, Davis	Physics	M.A., 1985
University of California, Irvine	Physics	1985–1987
University of California, San Diego (Scripps Institution of Oceanography)	Physical Oceanography	Ph.D., 1992

Appointments

Applied Physics Laboratory, University of Washington:

2021–present	Affiliate
2014–2016	Senior Principal Oceanographer
1999–2014	Senior Oceanographer
1994–1999	Oceanographer
1992–1994	Postdoctoral Research Scientist

Nansen Environmental and Remote Sensing Center (NERSC), Bergen, Norway:

2015–2018	Research Scientist
2011–2, 2013	Visiting Scientist

School of Oceanography, University of Washington:

2008–2015	Affiliate Associate Professor of Oceanography
1999–2008	Affiliate Assistant Professor of Oceanography

Scripps Institution of Oceanography, University of California, San Diego:

1987–1992	Research Assistant
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Physics Departments, University of California, Davis and Irvine:

1983–1987	Teaching and Research Assistants
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Other:

Nov. 2016	Visiting Scientist, Laboratoire d’Océanographie Physique et Spatiale (LOPS), IFREMER, Plouzané, France
2011–2012	Fulbright Scholar, NERSC, Bergen, Norway
2004–2005	Visiting Scientist, National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand
1982–1983	Technician, Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California

Service, Honors

- Acoustical Oceanography Technical Committee, Acoustical Society of America, 1993–1995; 1999–2001; 2007–2010; 2010–2013; 2014–2016
- Member of Acoustical Society of America and the American Geophysical Union (1992-2015).
- 2007 Medwin Prize in Acoustical Oceanography from the Acoustical Society of America. "For contributions to the acoustic measurement of climate change."
- 2011-2012 Fulbright Scholar, NERSC, Bergen, Norway
Acoustical Applications for an Arctic Ocean Observing System

Research Grants and Contracts (1994-2018)

A Study of Baroclinic and Barotropic Tides in the Western North Atlantic Using Long-Range Acoustic Transmissions (NSF:OCE-9415650)
11/94–10/97; \$144,000

Internal Tides of the Western North Atlantic (NSF:OCE-9720680)
3/98–2/02; \$256,000

Collaborative Proposal: Hawaiian Tidal Energy Budget Experiment: Tomographic Contribution (a component of the Hawaiian Ocean Mixing Experiment, H.O.M.E.) (NSF:OCE-9819527)
5/00–4/03; \$420,000

Collaborative Research - SGER - Model Verification of Radiation of Barotropic Energy from the Gulf Stream (NSF: OCE-0401385)
2004; \$25,118

North Pacific Acoustic Laboratory: Analysis of Shadow Zone Ray Arrivals and Acoustic Propagation in Numerical Ocean Models (ONR: N00014-06-1-0152)
12/05–11/08; \$323,993

Internal Tides, Altimetry and the Subtropical Catastrophe: A Global Search for Loss of Low-Mode Internal Tide Energy at 28.9 degrees Latitude (NSF:OCE-0647743)
3/07–2/10; \$192,745

Antipodal Acoustic Propagation and a Half-Century of Ocean Warming (NSF: OCE-0850357)
3/09–2/12; \$245,032

Predictability of Short-Period Variability in the Philippine Sea and the Influence of Such Variability on Long-Range Acoustic Propagation (ONR: N00014-09-1-0446)
2/09–1/12; \$479,514

Design and Planning of Long-Range Acoustic Remote Sensing Applications for an Arctic Ocean Observing System. Fulbright Scholarship.
9/11–2/12; \$24,000

ACOBAR Visiting Scientist: Acoustic Technology for Observing the Interior of the Arctic Ocean. Nansen Environmental and Remote Sensing Center, Bergen, Norway.
9/11–2/12; 02/13–4/13; \$46,000

The Predictability of Large-Scale, Short-Period Ocean Variability in the Philippine Sea and the Influence of Such Variability on Long-Range Acoustic Propagation (ONR: N00014-12-1-0183)
1/12–12/14; \$359,877

Assessing the Predictability of Mode-1 Internal Tides Over the World's Oceans using Satellite Altimetry (NASA: NNX13AE27G)
1/13–1/16; \$360,667

Acoustic Tomography in Fram Strait and Arctic Ocean (ONR: N00014-15-1-1186)
4/15–5/18; \$387,925

Publications

A. Refereed Publications

ATOC Group: A. B. Baggeroer, T. G. Birdsall, C. Clark, J. A. Colosi, B. D. Cornuelle, D. Costa, B. D. Dushaw, M. Dzieciuch, A. M. G. Forbes, B. M. Howe, D. Menemenlis, J. A. Mercer, K. Metzger, W. H. Munk, R. C. Spindel, P. F. Worcester, C. Wunsch, 1999. A test of basin-scale acoustic thermometry using a large-aperture vertical array at 3250-km range in the eastern North Pacific Ocean, *J. Acoust. Soc. Am.*, **105**, 3185–3201.

ATOC Consortium: A. B. Baggeroer, T. G. Birdsall, C. Clark, J. A. Colosi, B. D. Cornuelle, D. Costa, B. D. Dushaw, M. Dzieciuch, A. M. G. Forbes, C. Hill, B. M. Howe, J. Marshall, D. Menemenlis, J. A. Mercer, K. Metzger, W. Munk, R. C. Spindel, P. F. Worcester, and C. Wunsch, 1999. Reply to 'Heat content changes in the Pacific Ocean' by Kelly et al., *Science*, **284**, 1735a.

The ATOC Consortium, 1998. Ocean Climate Change: Comparison of acoustic tomography, satellite altimetry, and modeling, *Science*, **281**, 1327–1332.

Andrew, R. K., B. M. Howe, J. A. Mercer, and the NPAL Group: J. A. Colosi, B. D. Cornuelle, B. D. Dushaw, M. A. Dzieciuch, B. M. Howe, J. A. Mercer, W. H. Munk, R. C. Spindel, and P. F. Worcester, 2005. Transverse horizontal spatial coherence of deep arrivals at megameter ranges. *J. Acoust. Soc. Am.*, **117**, pp. 1511–1526.

Baggeroer, A. B., E. K. Sheer, and the NPAL Group: J. A. Colosi, B. D. Cornuelle, B. D. Dushaw, M. A. Dzieciuch, B. M. Howe, J. A. Mercer, W. H. Munk, R. C. Spindel, and P. F. Worcester, 2005. Statistics and vertical directionality of low-frequency ambient noise at the North Pacific Acoustic Laboratory site. *J. Acoust. Soc. Am.*, **117**, pp. 1643–1665.

Carrere, L., B. K. Arbic, B. Dushaw, G. Egbert, S. Erofeeva and co-authors, 2021. Accuracy assessment of global internal-tide models using satellite altimetry. *Ocean Sci.*, **17**, 147–180. doi: 10.5194/os-17-147-2021

Colosi, J. A., L. J. Van Uffelen, B. D. Cornuelle, M. A. Dzieciuch, P. F. Worcester, B. D. Dushaw, and S. R. Ramp, 2013. Observations of sound-speed fluctuations in the western Philippine Sea in the spring of 2009, *J. Acoust. Soc. Am.*, **134**. doi: 10.1121/1.4818784

- Colosi, J. A., A. B. Baggeroer, B. D. Cornuelle, M. A. Dzieciuch, W. H. Munk, P. F. Worcester, B. D. Dushaw, B. M. Howe, J. A. Mercer, R. C. Spindel, T. G. Birdsall, K. Metzger, A. M. G. Forbes, 2005. Analysis of multipath acoustic field variability and coherence in the finale of broadband basin-scale transmissions in the North Pacific Ocean, *J. Acoust. Soc. Am.*, **117**, 1538–1564.
- Colosi, J. A., and the ATOC Group (A. B. Baggeroer, T. G. Birdsall, C. Clark, J. A. Colosi, B. D. Cornuelle, D. Costa, B. D. Dushaw, M. Dzieciuch, A. M. G. Forbes, B. M. Howe, D. Mene-menlis, J. A. Mercer, K. Metzger, W. H. Munk, R. C. Spindel, P. F. Worcester, C. Wunsch), 1999. A review of recent results on ocean acoustic wave propagation in random media: Basin scales, *IEEE J. Oceanic Engineering*, **24**, 138–155.
- Dushaw, B. D., 2022. Surprises in physical oceanography: Contributions from ocean acoustic tomography, *Tellus A: Dynamic Meteorology and Oceanography*, **74**, 33–67. doi: 10.16993/tellusa.39
- Dushaw, B. D., 2018. Ocean acoustic tomography in the North Atlantic, *J. Atmos. Ocean. Tech.*, **36**, 183–202. doi: 10.1175/JTECH-D-18-0082.1
- Dushaw, B. D., 2017. "Ocean Observing Systems and Ocean Observatories, Oceanographers and Acousticians - A Personal Perspective" in *Applied Underwater Acoustics*, L. Bjørnø (T. Neighbors, D. Bradley, Eds.) Amsterdam, Netherlands: Elsevier, ISBN: 978-0-12-811240-3, 964 pp.
- Dushaw, B. D., 2015. WIGWAM reverberation revisited, *Bulletin Seismological Soc. Am.*, **105**, 2242–2249. doi: 10.1785/0120150024
- Dushaw, B. D., 2014. Assessing the horizontal refraction of ocean acoustic tomography signals using high-resolution ocean state estimates, *J. Acoust. Soc. Am.*, **136**, 1–8. doi: 10.1121/1.4881928
- Dushaw, B. D., 2013. "Ocean Acoustic Tomography" in *Encyclopedia of Remote Sensing*, E. G. Njoku, Ed., Springer, Springer-Verlag Berlin Heidelberg, 2013. doi: 10.1007/SpringerReference_331410
- Dushaw, B. D., 2011. Towards global predictions of the mode-1 internal tide, *Geophysical Research Letters*, rejected.
- Dushaw, B. D., 2008. Another look at the 1960 Perth to Bermuda long-range acoustic propagation experiment, *Geophys. Res. Lett.*, **35**, L08601, 5 pp. doi: 10.1029/2008GL033415
- Dushaw, B. D., 2006. Mode-1 internal tides in the western North Atlantic. *Deep Sea Res. I*, **53**, 449–473. doi: 10.1016/j.dsr.2005.12.009
- Dushaw, B. D., 2003. On the mapping and wavenumber resolution of line-integral data for observations of low-mode internal tides, *J. Atmos. Oceanic Tech.*, **20**, 1043–1059. doi: 10.1175/1458.1
- Dushaw, B. D., 2002. Mapping low-mode internal tides near Hawaii using TOPEX/POSEIDON altimeter data, *Geophys. Res. Lett.*, **29**, 91-1–91-4. doi: 10.1029/2001GL013944

- Dushaw, B. D., 1999. Inversion of multimegahertz range acoustic data for ocean temperature. *IEEE J. Oceanic Engineering*, **24**, 215–223. doi: 10.1109/48.757272
- Dushaw, B. D., 1992. *The 1987 Gyre Scale Reciprocal Acoustic Tomography Experiment*. Ph.D. thesis, University of California, San Diego.
- Dushaw, B. D., and D. Menemenlis, 2023. Resonant diurnal internal tides in the North Atlantic: 2. Modeling. *Geophysical Research Letters*, **50**, e2022GL101193. doi: 10.1029/2022GL101193
- Dushaw, B. D., and H. Sagen, 2017. The role of simulated small-scale ocean variability in inverse computations for ocean acoustic tomography, *J. Acoust. Soc. Am.*, **142**, 3541–3552, doi: 10.1121/1.5016816
- Dushaw, B. D., and H. Sagen, 2016. A comparative study of moored/point and acoustic tomography/integral observations of sound speed in Fram Strait using objective mapping techniques, *J. Atmos. Oceanic Tech.*, **33**, 2079–2093. doi: 10.1175/JTECH-D-15-0251.1
- Dushaw, B. D., and D. Menemenlis, 2014. Antipodal acoustic thermometry: 1960, 2004, *Deep-Sea Res. I*, **86**, 1–20. doi: 10.1016/j.dsr.2013.12.008
- Dushaw, B. D., and P. F. Worcester, 1998. Resonant diurnal internal tides in the North Atlantic, *Geophys. Res. Lett.*, **25**, 2189–2193. doi: 10.1029/98GL01583
- Dushaw, B. D., F. Gaillard, and T. Terre, 2017. Acoustic tomography in the Canary Basin: Meddies and tides, *J. Geophys. Res.*, **122**, 8983–9003. doi: 10.1002/2017JC013356
- Dushaw, B. D., H. Sagen and A. Beszczynska-Möller, 2016. Sound speed as a proxy variable to temperature in Fram Strait, *J. Acoust. Soc. Am.*, **140**, 622–630. doi: 10.1121/1.4959000
- Dushaw, B. D., H. Sagen, and A. Beszczynska-Möller, 2016. On the effects of small-scale variability on acoustic propagation in Fram Strait: The tomography forward problem, *J. Acoust. Soc. Am.*, **140**, 1286–1299. doi: 10.1121/1.4961207
- Dushaw, B. D., P. F. Worcester, M. A. Dzieciuch, and D. Menemenlis, 2013. On the time-mean state of ocean models and the properties of long-range acoustic propagation, *J. Geophys. Res. Oceans*, **118**. doi: 10.1002/jgrc.20325
- Dushaw, B. D., P. F. Worcester, and M. A. Dzieciuch, 2011. On the predictability of mode-1 internal tides, *Deep-Sea Res. I*, **58**, 677–698. doi: 10.1016/j.dsr.2011.04.002
- Dushaw, B., W. Au, A. Beszczynska-Möller, R. Brainard, B. D. Cornuelle, T. Duda, M. Dzieciuch, A. Forbes, L. Freitag, J.-C. Gascard, A. Gavrilov, J. Gould, B. Howe, S. R. Jayne, O. M. Johannessen, J. F. Lynch, D. Martin, D. Menemenlis, P. Mikhalevsky, J. H. Miller, S. E. Moore, W. H. Munk, J. Nystuen, R. I. Odom, J. Orcutt, T. Rossby, H. Sagen, S. Sandven, J. Simmen, E. Skarsoulis, B. Southall, K. Stafford, R. Stephen, K. J. Vigness-Raposa, S. Vinogradov, K. B. Wong, P. F. Worcester, C. Wunsch, 2010. A Global Ocean Acoustic Observing Network, In *Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2)*, Venice, Italy, 21-25 September 2009, Hall, J., Harrison, D.E. & Stammer, D., Eds., ESA Publication WPP-306.

- Dushaw, B. D., P. F. Worcester, W. H. Munk, R. C. Spindel, J. A. Mercer, B. M. Howe, K. Metzger Jr., T. G. Birdsall, R. K. Andrew, M. A. Dzieciuch, B. D. Cornuelle, and D. Menemenlis, 2009. A decade of acoustic thermometry in the North Pacific Ocean, *J. Geophys. Res.*, **114**, C07021. doi: 10.1029/2008JC005124
- Dushaw, B. D., G. Bold, C.-S. Chui, J. Colosi, B. Cornuelle, Y. Desaubies, M. Dzieciuch, A. Forbes, F. Gaillard, J. Gould, B. Howe, M. Lawrence, J. Lynch, D. Menemenlis, J. Mercer, P. Mikhaelovsky, W. Munk, I. Nakano, F. Schott, U. Send, R. Spindel, T. Terre, P. Worcester, and C. Wunsch, 2001. "Observing the ocean in the 2000's: A strategy for the role of acoustic tomography in ocean climate observation" in *Observing the Oceans in the 21st Century*, edited by C. J. Koblinsky and N. R. Smith (GODAE Project Office and Bureau of Meteorology, Melbourne), pp. 391–418.
- Dushaw, B. D., B. M. Howe, J. A. Mercer, R. C. Spindel, and the ATOC Group, 1999. Multi-megameter range acoustic data obtained by bottom-mounted hydrophone arrays for measurement of ocean temperature. *IEEE J. Oceanic Engineering*, **24**, 202–214. (Invited)
- Dushaw, B. D., G. D. Egbert, P. F. Worcester, B. D. Cornuelle, B. M. Howe, and K. Metzger, 1997. A TOPEX/POSEIDON global tidal model (TPXO.2) and barotropic tidal currents determined from long-range acoustic transmissions. *Prog. Oceanogr.*, **40**, 337–367. doi: 10.1016/S0079-6611(98)00008-1
- Dushaw, B. D., P. F. Worcester, B. D. Cornuelle, B. M. Howe, and D. S. Luther, 1995. Baroclinic and barotropic tides in the central North Pacific Ocean determined from long-range reciprocal acoustic transmissions. *J. Phys. Oceanogr.*, **25**, pp. 631–647.
- Dushaw, B. D., P. F. Worcester, B. D. Cornuelle, and B. M. Howe, 1994. Barotropic currents and vorticity in the central North Pacific during summer 1987 determined from long-range reciprocal acoustic transmissions. *J. Geophys. Res.*, **99**, pp. 3263–3272.
- Dushaw, B. D., P. F. Worcester, B. D. Cornuelle, and B. M. Howe, 1993. Variability of heat content in the central North Pacific in summer 1987 determined from long-range acoustic transmissions. *J. Phys. Oceanogr.*, **23**, pp. 2650–2666.
- Dushaw, B. D., P. F. Worcester, B. D. Cornuelle, and B. M. Howe, 1993. On equations for the speed of sound in seawater. *J. Acoust. Soc. Am.*, **93**, pp. 255–275. doi: 10.1121/1.405660
- Geyer, F., H. Sagen, B. Dushaw, A. Yamakawa, M. Dzieciuch, T. Hamre, 2022. A dataset consisting of a two-year long temperature and sound speed time series from acoustic thermometry in Fram Strait. *Data in Brief*, **108118**. doi: 10.1016/j.dib.2022.108118
- International Altimetry Team, 2021. Altimetry for the future: building on 25 years of progress. *Adv. Space Res.*, **68**, 319–363. doi: 10.1016/j.asr.2021.01.022
- Ma, B. B., B. D. Dushaw, and B. M. Howe, 2022. Rainfall at sea – Using the underwater sounds of raindrops as a rain gauge for weather and climate, *Acoustics Today*, **18**, 62–71. doi: 10.1121/AT.2022.18.2.62
- Mercer, J. A., B. D. Dushaw, B. M. Howe, and R. C. Spindel, 1999. Acoustic monitoring in the Northeast Pacific at megameter ranges (U), *U.S. Navy J. Underwater Acoust.*, **49**, 781–788 (SECRET 4850).

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- Roux, P., W. A. Kuperman, and the NPAL Group: J. A. Colosi, B. D. Cornuelle, B. D. Dushaw, M. A. Dzieciuch, B. M. Howe, J. A. Mercer, W. H. Munk, R. C. Spindel, and P. F. Worcester, 2004. Extracting coherent wave fronts from acoustic ambient noise in the ocean. *J. Acoust. Soc. Am.*, **116**, 1995–2003.
- Sagen, H., F. Geyer, S. Sandven, M. Babiker, B. D. Dushaw, P. F. Worcester, M. A. Dzieciuch, B. Cornuelle, A. Beszczynska-Möller, 2017. Resolution, identification, and stability of broadband acoustic arrivals in Fram Strait, *J. Acoust. Soc. Am.*, **141**, 2055–2068, doi: 10.1121/1.4978780
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2005. The effect of bottom interaction on transmissions from the NPAL Kauai source, *J. Acoust. Soc. Am.*, **93**, pp. 1624–1634.
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- Worcester, P. F., M. A. Dzieciuch, J. A. Mercer, R. K. Andrew, B. D. Dushaw, A. B. Baggeroer, K. D. Heaney, G. L. D'Spain, J. A. Colosi, R. A. Stephen, J. N. Kemp, B. M. Howe, L. J. Van Uffelen, and K. E. Wage, 2013. The North Pacific Acoustic Laboratory (NPAL) deep-water acoustic propagation experiments in the Philippine Sea, *J. Acoust. Soc. Am.*, **131**, 3359–3375. doi: 10.1121/1.4818887

B. Reports and Conference Proceedings

- Applied Physics Laboratory (APL), 1994. APL-UW High-Frequency Ocean Environmental Acoustic Models Handbook, TR 9407, APL, University of Washington, October 1994.
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- Dushaw, B. 2017. Acoustic tomography as a component the Atlantic Ocean Observing System: Opportunities and challenges, in Proceedings of the Annual GOVST-VIII meeting, Global Ocean Data Assimilation Experiment (GODAE) Oceanview Science Team, Bergen, Norway, 6–10 November 2017, 5 pp.
- Dushaw, B., 2017. Acoustic tomography as a component the Atlantic Ocean Observing System: Opportunities and challenges, in Proceedings of the 8th EuroGOOS Conference: Operational Oceanography serving sustainable marine development, Bergen, Norway, 3–5 October 2017, 5 pp.
- Dushaw, B. D., 2017. "Estimating temperature in Fram Strait using DAMOCLES and ACOBAR acoustic tomography data by exploiting small-scale variability," NERSC Technical Report 378, Nansen Environmental and Remote Sensing Center, Bergen, Norway, 6 November 2017, 43 pp.

- Dushaw, B., 2017. WIGWAM reverberation revisited, in Proceedings Underwater Acoustics Conference and Exhibition 2017, Skiathos Island, Greece, 3–8 September 2017, 5 pp.
- Dushaw, B., and H. Sagen, 2017. The role of simulated small-scale ocean variability in inverse computations for ocean acoustic tomography, in Proceedings Underwater Acoustics Conference and Exhibition 2017, Skiathos Island, Greece, 3–8 September 2017, 8 pp.
- Dushaw, B., F. Gaillard, and T. Terre, 2017. Acoustic tomography in the Canary Basin: Meddies and tides, in Proceedings Underwater Acoustics Conference and Exhibition 2017, Skiathos Island, Greece, 3–8 September 2017, 7 pp.
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D. Web Pages

HOME PAGE: <http://faculty.washington.edu/dushaw/>

NPAL: <http://npal.ucsd.edu> (with P. Worcester and M. Dzieciuch)

NANOOS: <http://www.nanoos.org> (preliminary implementation)

The Heard Island Feasibility Test: <http://faculty.washington.edu/dushaw/heard/index.shtml>

E. Contributions to Wikipedia Articles

Argo (oceanography), Beta Decay, Blog, Chamberlin Trimetric Projection, Discovery of the Neutron, Dismissal of U.S. Attorneys Controversy, Donald Trump, Elizabeth Noble Shor, Ellen Simonetti, Emma Brossard, Fram Strait, George G. Shor, Herbert H. Chen, Montjuïc (Girona), Neutron, Neutron Magnetic Moment, Norman Feather, Nuclear Force, Ocean Acoustic Tomography, Project Mohole, Proton Magnetic Moment, Ribbon Ridge AVA, San Tomé, Venezuela, Third Siege of Girona, Unilateral Hearing Loss, Valley of Stability, Wayback Machine (Peabody's Improbable History), Walter Munk

F. Publicity on the Internet

New York Times (10/27/98):

<http://www.nytimes.com/library/national/science/102798sci-sound.html>

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