Wayne H. Slade, Ph.D.

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Education

2011 **Ph.D., Oceanography, University of Maine, School of Marine Sciences**
"Optical Signatures of Particle Size and Dynamics in the Marine Environment"
Advisor: Emmanuel Boss

2004 **M.S., Electrical Engineering, University of Maine, School of Engineering**
"Computational Intelligence Approaches to Ocean Color Inversion"
Advisor: Habtom Ressom

2000 **B.S., Electrical Engineering, University of Maine, School of Engineering**

Work Experience

2019– **Vice President of Science and Technology, Sequoia Scientific, Inc., Bellevue, WA**
Continued duties as Scientist, increasing focus on developing new instrument technologies.

2011–2019 **Scientist, Sequoia Scientific, Inc., Bellevue, WA**
Instrument R&D, engineering, and testing. Developed externally-funded program for new instrument R&D, basic, and applied ocean optics research, including planning and conducting fieldwork, data analysis, and presentation of results.

2004–2011 **Research Assistant, University of Maine, MISC Lab, Orono, ME**
Ocean optics research, including ONR and NASA-funded field campaigns, extensive data analysis and dissemination of results. Teaching assistant for undergraduate marine science labs and intensive graduate level ocean optics summer course.

1997–2004 **Research Assistant, University of Maine, Intelligent Systems Lab, Orono, ME**
Ocean color remote sensing and computational intelligence research, data analysis and dissemination of results. Developed user-friendly MS Windows application for data analysis and neural network modeling.

Publications

Refereed Journal Articles

2018 E. Boss, N. Haëntjens, T. K. Westberry, L. Karp-Boss, and **W. H. Slade,** "Validation of the particle size distribution obtained with the laser in-situ scattering and transmission (LISST) meter in flow-through mode," Opt. Express 26, 11125–11136.

2017 A. P. Chase, E. Boss, I. Cetinić, and **W. H. Slade**, "Estimation of phytoplankton accessory pigments from hyperspectral reflectance spectra: Toward a global algorithm," J. Geophys. Res. Oceans 122.

2016 I. Cetinić, N. Poulton, and **W. H. Slade**, "Characterizing the phytoplankton soup: pump and plumbing effects on the particle assemblage in underway optical seawater systems," Opt. Express 24, 20703–20715.

2016 M. Ottaviani et al., "Airborne and shipborne polarimetric measurements over open ocean and coastal waters: Intercomparisons and implications for spaceborne observations," Remote Sens. Environ. 206, 375–390.

2015 **W. H. Slade** and E. Boss, "Spectral attenuation and backscattering as indicators of average particle size," Appl. Opt. 54, 7264–7277.

2013 E. Boss, H. Gildor, **W. H. Slade**, L. Sokoletsky, A. Oren, and J. Loftin, "Optical properties of the Dead Sea," J. Geophys. Res. Oceans 118.

2013 E. Boss, M. Picheral, T. Leeuw, A. Chase, E. Karsenti, G. Gorsky, L. Taylor, **W. H. Slade**, J. Ras, and H. Claustre, "The characteristics of particulate absorption, scattering and attenuation coefficients in the surface ocean; Contribution of the Tara Oceans expedition," Methods Oceanogr. 7, 52–62.

2013 N. Briggs, **W. H. Slade**, E. Boss, and M. Perry, "Method for estimating mean particle size from high-frequency fluctuations in beam attenuation or scattering measurements," Appl. Opt. 52, 6710–6725.

2013 T. Leeuw, S. Newburg, E. Boss, **W. H. Slade**, M. Soroka, J. Pederson, C. Chryssostomidis, and F. Hover, "Remote identification of the invasive tunicate Didemnum vexillum using reflectance spectroscopy," Appl. Opt. 52, 1758–1763.

2011 **W. H. Slade**, E. Boss, and C. Russo, "Effects of particle aggregation and disaggregation on their inherent optical properties," Opt. Express 19, 7945–7959.

2010 **W. H. Slade**, E. Boss, G. Dall'Olmo, M. R. Langner, J. Loftin, M. J. Behrenfeld, C. Roesler, and T. K. Westberry, "Underway and moored methods for improving accuracy in measurement of spectral particulate absorption and attenuation," J. Atmos. Ocean. Technol. 27, 1733–1746.

2009 E. Boss, **W. H. Slade**, M. Behrenfeld, and G. Dall'Olmo, "Acceptance angle effects on the beam attenuation in the ocean," Opt. Express 17, 1535–1550.

2009 E. Boss, **W. H. Slade**, and P. Hill, "Effect of particulate aggregation in aquatic environments on the beam attenuation and its utility as a proxy for particulate mass," Opt. Express 17, 9408–9420.

2009 G. Dall'Olmo, T. K. Westberry, M. J. Behrenfeld, E. Boss, and **W. H. Slade**, "Significant contribution of large particles to optical backscattering in the open ocean," Biogeosciences 6, 947–967.

2006 **W. H. Slade** and E. Boss, "Calibrated near-forward volume scattering function obtained from the LISST particle sizer," Opt. Express 14, 3602–3615.

2004 **W. H. Slade**, H. W. Ressom, M. T. Musavi, and R. L. Miller, "Inversion of ocean color observations using particle swarm optimization," IEEE Trans. Geosci. Remote Sens. 42, 1915–1923.

Book Chapters

2005 H. Ressom, R. L. Miller, P. Natarajan, and **W. H. Slade**, "Computational Intelligence and its Application in Remote Sensing," in Remote Sensing of Coastal Aquatic Environments, R. Miller, C. Castillo, and B. McKee, eds. (Springer).

Awards, Honors, and Fellowships

2008 Best Student Paper, Ocean Optics XIX Conference, Tuscany, Italy.

2004 Best Student Paper, IEEE Congress on Evolutionary Computation (CEC 2004), Portland, OR.

2002 Best Student Paper, 7th International Conference on Remote Sensing for Marine and Coastal Environments, Miami, FL.

2001 NASA Graduate Student Researchers Project Fellowship.

1999 Eta Kappa Nu, Electrical Engineering Honor Society.

1998 NSF Research Experiences for Undergraduates Fellowship, "An Artificial Neural Network System for Automated DNA Base-calling."

Funded Research, Development, and Consulting

2018– "Statistical Modeling in Support of the Lower Passaic River Water Column Monitoring Project," consulting subcontract with Tetra Tech, Inc., $93,547.

2017– "Instrument for Measurement of Hyperspectral Backscattering in Natural Waters," NASA Phase II SBIR, $734,799 two year budget.

2016 LISST-Glider, ONR DURIP to T. Miles (Rutgers), custom integration of LISST instrument into Slocum gliders, $410,000.

2016 "Investigating an Instrument for Measurement of Hyperspectral Backscattering in Natural Waters," NASA Phase I SBIR, $121,100.

2016– "Instrument for Measurement of Oceanic Particle Size Distribution from Submicron to Mesoplankton," NASA Phase II SBIR, $742,985 two year budget.

2016 "Resolving Time Scales of Removal of Suspended Sediment with a Geostationary Ocean Color Satellite," ONR, PI E. Boss (UMaine), subcontract for fieldwork support, $20,700.

2015 "Measurement of Oceanic Particle Size Distribution in Support of Carbon Cycle Research and Ocean Color Remote Sensing," Schmidt Ocean Institute, Co-I with I. Cetinić (PI, NASA GSFC), P. J. Werdell (NASA GSFC), and M. Estapa (Skidmore), 21 days ship time, R/V Falkor.

2015 "Instrument for Measurement of Oceanic Particle Size Distribution from Submicron to Mesoplankton," NASA Phase I SBIR, $124,496.

2014– "Understanding natural variability of VSFs and its impact on biogeochemical retrieval from ocean color," NASA PACE Science Team, Co-I with X. Zhang (PI, UND) and D. Gray (NRL), $54,000 subaward total FY15–17, extended through 2020.

2012 "A Compact In Situ Sensor for Measurement of Absorption and Backscattering in Natural Waters," NASA Phase I SBIR, $124,455.

2012–2015 "Multi-Sensor, Ecosystem-Based Approaches for Estimation of Particulate Organic Carbon," NASA Ocean Biology and Biogeochemistry, Co-I with I. Cetinić (PI, UMaine), N. Poulton (Bigelow Lab) and M. J. Perry (UMaine), $977,177 total budget, $297,447 subaward total FY13–15.

Field Experience

2017 R/V Falkor, Sea to Space Particle Investigation (Co-Investigator), Honolulu, HI to Portland, OR, measurements: flowthrough optics, in situ radiometry, CTD stations, biogeochemistry, 20 January–17 February.

2014 R/V New Horizon, NH1418, transect from Honolulu, HI to 3S, 150W, measurements: flowthrough optics, in situ radiometry, CTD stations, biogeochemistry, 19 September–8 October.

2014 Ship-Aircraft BioOptical Research (SABOR) project, R/V Endeavor, EN542, Narragansett, RI , to Gulf of Maine, North Atlantic, Sargasso Sea, and return, measurements: flowthrough optics, in situ radiometry, CTD stations, biogeochemistry, 18 July–5 August.
Focus of SABOR project was exploring and advancing technology for measuring biogeochemistry from space, using coordinated measurements between R/V and airborne lidar and polarimetry.

2013 R/V Atlantic Explorer, AE1319, E. Boothbay, ME to Labrador Sea to Bermuda, measurements: flowthrough optics, in situ radiometry, CTD stations, biogeochemistry, 20 August–11 September.

2013 R/V Revelle, RR1305-1306, Kaoshiung, Taiwan to Luzon Strait and South China Sea, measurements: flowthrough optics, in situ radiometry, 5–27 May.

2009 R/V Tara, responsible for installing and sea-trial of flowthrough optical instrumentation on vessel for Tara Expeditions three-year exploratory circumnavigation.

2008 R/V Melville, Philippines Straits Dynamics Experiment (PhilEx), measurements: flow-through optics, CTD and bio-optical casts, and radiometry, 6–28 February.

2006 R/V Ka'imimoana, GP1-06 and GP5-06, Honolulu, HI to Equatorial Pacific transects along 125W and 140W from +/-12N, measurements: flowthrough optics, in situ radiometery, CTD stations, biogeochemistry, 6 January–9 February and 17 August–24 September.

2009, 2007, 2005, 2004 WHOI Martha's Vineyard Coastal Observatory (MVCO), Optics Acoustics and Stress In Situ (OASIS), bottom tripods in cabled observatory infrastructure. Deployments were designed to capture optical and acoustical signatures of strong physical forcing and particle dynamics, and were timed to capture summer-fall transitional storms and hurricanes (September–October). Responsible for coordinating deployment of all OASIS assets at MVCO in 2009.

Conferences and Workshops

Conference Presentations (First Author)

(*) paper available in conference proceedings, (†) invited presentation

2018 W. H. Slade and Y. Agrawal, "Measuring near-π backscattering, …where we left off," Recent ADvances in LIDAR (RAD-LIDAR), HBOI, Fort Pierce, FL, 5–6 November.

2018 W. H. Slade and Y. Agrawal, "Measuring light backscattering for lidar applications," Particles in Europe (PiE), Lisbon, Portugal, 14–17 October.

2018 W. H. Slade, Y. Agrawal, and T. Leeuw, "Developing an instrument for measurement of oceanic particle size distribution in ship-based underway flow-through systems," Ocean Optics XXIV, Dubrovnik, Croatia, 7–12 October.

2016 W. H. Slade and Y. C. Agrawal, "Laser scattering instrument for measurement of oceanic particle size distribution from submicron to mesoplankton," Ocean Sciences Meeting, New Orleans, LA, 23–28 February.

2015 W. H. Slade, Y. C. Agrawal, D. R. Dana, T. Leeuw, and C. Pottsmith, "LISST-ABS: A Low-Cost Submersible Acoustic Sediment Sensor," AGU Fall Meeting, San Francisco, CA, 14–18 December.

2014 W. H. Slade, I. Cetinić, M. J. Perry, N. Poulton, "Fracex: Toward understanding the effects of 'particle community' on particulate organic carbon optical proxies," Ocean Sciences Meeting, Honolulu, HI, 21–26 February.

2013 W. H. Slade, Y. C. Agrawal, and O. A. Mikkelsen, "Comparison of measured and theoretical scattering and polarization properties of narrow size range irregular sediment particles," MTS/IEEE Oceans Conference, San Diego, CA, 23–27 September.*

2012 W. H. Slade, N. Briggs, and E. Boss, "High-frequency fluctuations in optical measurements reflect changes in particle size distribution in a bottom nepheloid layer," Ocean Sciences Meeting, Salt Lake City, UT, 20–24 February.

2012 W. H. Slade, Y. C. Agrawal, and O. A. Mikkelsen, "Measurement of particle optical scattering and polarization properties using the LISST-VSF," Particles in Europe (PiE), Barcelona, Spain, 16–19 October.

2012 W. H. Slade, Y. C. Agrawal, O. A. Mikkelsen, "Measurement of angular volume scattering and polarization properties of narrow size range sediments," Ocean Optics XXI, Glasgow, Scotland, 8–12 October.*

2010 W. H. Slade and E. Boss, "Spectral attenuation and backscattering as indicators of particle size distribution," Ocean Optics XX, Anchorage, AK, September 25–1 October.*

2010 W. H. Slade and E. Boss, "Optical consequences of particle aggregation," Ocean Sciences Meeting, Portland, OR, 22–26 February.†

2008 W. H. Slade and E. Boss, "Significance of particle aggregation on their optical properties," Ocean Optics XIX, Il Ciocco, Tuscany, Italy, 6–10 October. Awarded Best Student Paper.*

2008 W. H. Slade and E. Boss, "Is the spectral shape of particle backscattering a good indicator of particle size?" Ocean Sciences Meeting, Orlando, FL, 2–7 March.

2006 W. H. Slade and E. Boss, "Volume scattering function variability in a nearshore bottom nepheloid layer," Ocean Optics XVIII, Montreal, Quebec, 9–13 October. Honorable Mention for Best Student Paper.*

2006 W. H. Slade, M. R. Langner, E. Boss, and C. Roesler, "Retrieving in situ particulate absorption spectra in optically clear waters: An example from the Equatorial Pacific," Ocean Optics XVIII, Montreal, Quebec, 9–13 October.*

2006 W. H. Slade, E. Boss, T. G. Milligan, P. S. Hill, and J. H. Trowbridge, "Observations of particle dynamics during OASIS 2004 and 2005, "2006 Ocean Sciences Meeting, Honolulu, HI, 20–24 February.

2005 W. H. Slade and E. Boss, "Observations of optical properties during a coastal resuspension event - Implications for remote sensing of suspended sediments," 8th International Conference on Remote Sensing for Marine and Coastal Environments, Halifax, Nova Scotia, 17–19 May.

2004 W. H. Slade, E. Boss, and L. Azevedo, "Calibration of the LISST-100 to provide near-forward volume scattering function," Ocean Optics XVII, Freemantle, Australia, 25–29 October.*

2004 W. H. Slade, H. Ressom, M. T. Musavi, and R. L. Miller, "Ocean color inversion by particle swarm optimization," IEEE Congress on Evolutionary Computation (CEC 2004), Portland, OR, 19–23 June. Awarded Best Student Paper.*

2004 W. H. Slade, R. L. Miller, H. Ressom, and P. Natarjan, "Neural network retrieval of phytoplankton abundance from remotely-sensed ocean radiance," IASTED International Conference on Neural Networks and Computational Intelligence (NCI 2004), Grindelwald, Switzerland, 23–25 February.*

2003 W. H. Slade, R. L. Miller, H. Ressom, and P. Natarjan, "Ensemble neural network methods for satellite-derived estimation of chlorophyll a," International Joint Conference on Neural Networks (IJCNN), Portland, OR, 20–24 July.*

2002 W. H. Slade, R. L. Miller, H. Ressom, and P. Natarjan, "Improved modeling of satellite-derived chlorophyll a concentration using neural networks," Ocean Optics XVI, Santa Fe, NM, 18–22 November.*

2002 W. H. Slade, R. L. Miller, H. Ressom, and P. Natajan, "Neural network modeling of chl-a concentration from remotely sensed data," 7th International Conference on Remote Sensing for Marine and Coastal Environments, Miami, FL, 20–22 May. Awarded Best Student Paper.*

Workshop and Other Conference Participation

2015 Methods for Ship-based Flowthrough Optical Measurements for collaborators on NASA-funded PACE Science Team project "A Global Database of High Horizontal Resolution IOPs for Validation of Remotely Sensed Ocean Color" (PI E. Boss), Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, 12–13 March.

2015 NASA Ocean Particle Backscatter Field Protocol Workshop (co-organizer), Austin, TX, 9–10 March.

2014 Revisiting Protocols for In Situ Optical Measurements and Instrumentation, Ocean Optics Protocols Workshop, Ocean Optics XXII Conference, 25 October.

2012 Towards Optics-Based Measurements in Ocean Observatories, Ocean Observatories Workshop, Ocean Optics XXI Conference, 7 October.

2012 Consortium for Ocean Leadership/NASA Data QA/QC Workshop, concerning data quality for optical measurements obtained from ocean observatories, University of Maine Ira C. Darling Marine Center, 6–8 June. Report: http://oceancolor.gsfc.nasa.gov/DOCS/Data_QC_Workshop_Final_Report_2012-08-7.pdf.

Other Professional Activities

2018 Invited Lecture, "Measuring Optical Properties of Particles from Coastal to Ocean Waters," Korea Institute of Ocean Science and Technology (KIOST), Busan, South Korea, 8 March.

2017–2018 Co-organizer, "Particles in Europe (PiE) 2018" conference, Esbjerg, Denmark.

2015–2016 Planning committee member, Ocean Optics XXIII, Victoria, BC, Canada.

2013–2014 Co-organized "Particles in Europe (PiE) 2014" conference, Esbjerg, Denmark.

2014– Co-Investigator on the NASA PACE ocean color mission Science Team, serving on Environmental Methodologies, IOP Methodologies, and Datasets subgroups.

2013–2014 Planning committee member, Ocean Optics XXII, Portland, ME.

2007 Teaching assistant for an intensive (three-week, resident, cross-disciplinary, graduate level) special topics course "Application of Remote and In-situ Ocean Optical Measurements to Ocean Biogeochemistry," University of Maine Darling Marine Center, sponsored by NASA.

2006–2010 Senator for the School of Marine Sciences in the UMaine Graduate Student Government, including service on grants committee responsible for competitive graduate student travel and research awards.

2005– Reviewer for Applied Optics, Limnology and Oceanography, Optics Express, Marine Ecology Progress Series, Estuarine Coastal and Shelf Science, International Journal of Remote Sensing, and Frontiers in Marine Science.

2005–2010 Organizing committee of the UMaine School of Marine Sciences Graduate Research Symposium (yearly event for graduate students and faculty).

Professional Affiliations

2012– Optical Society of America (OSA)

2011– American Geophysical Union (AGU)

2006– American Society of Limnology and Oceanography (ASLO)

2006– The Oceanography Society (TOS)

2001–2014 IEEE (member of IEEE Young Professionals, the Geoscience and Remote Sensing Society, and the Oceanic Engineering Society)