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Research Interests

Dynamics and thermodynamics of the upper ocean; tropical dynamics and equatorial waves; air-sea interaction and exchange; oceanic internal waves and eddies; satellite oceanography; ocean observing and instrumentation.

These interests are pursued from an observational perspective using in situ observations, satellite observations, and, in some cases, laboratory and numerical models to test hypotheses and test or formulate simplified physical models that aid understanding.

Education

*Massachusetts Institute of Technology-
Woods Hole Oceanographic Institution*

*Ph.D., Physical Oceanography
(February 2007)
(S.M., September 2003)*

Supervisor: Robert A. Weller, Ph.D., Woods Hole Oceanographic Institution.

Ph.D. thesis title: Air-sea interaction at two contrasting sites in the eastern tropical Pacific: mesoscale variability and atmospheric convection at 10°N.

GPA 4.5/5.0 (equivalent to 3.5/4.0)

University of Oklahoma

*B.S., Physics
B.A., Philosophy
(June 2000)*

Supervisor: Eric Abraham, Ph.D. (Physics Department)

Thesis title: Design and Construction of a Magneto-Optical Trap for Demonstration of Bose-Einstein Condensation.

GPA 3.8/4.0

Selected Academic Honors:

Outstanding Student Paper Award, 2006 AGU Ocean Sciences meeting

MIT Presidential Fellowship, 2000-2001

Most Outstanding Physics Student, U. Oklahoma, 2000

Phi Beta Kappa

Golden Key National Honor Society

Sigma Pi Sigma (physics honor society)

National Merit Scholar

Employment

Assistant Scientist (7/2008 to present), Woods Hole Oceanographic Institution

Postdoctoral Investigator (11/2006 to 6/2008), Woods Hole Oceanographic Institution

Graduate Research Assistant (09/2004-11/2006 and 06/2000-08/2003), WHOI

Research Associate I (09/2003-08/2004), Woods Hole Oceanographic Institution

Student Laboratory Assistant (1998-2000), Magneto-optical trapping laboratory (atomic-molecular physics), Physics Department, University of Oklahoma

Research Intern (Summer, 1998), Indiana University Cyclotron Facility

Publications

Peer-reviewed Publications

- Farrar, J.T.** and Weller, R.A. 2006. Intraseasonal variability near 10°N in the eastern tropical Pacific Ocean. *J. Geophys. Res.*, 111, C05015, doi:10.1029/2005JC002989.
- Plueddemann, A.J. and **Farrar, J.T.** 2006. Observations and models of the energy flux from the wind to mixed-layer inertial currents. *Deep Sea Research II*, 53, 5-30, doi:10.1016/j.dsr2.2005.10.017.
- Edson, J.B., T. Crawford, J. Crescenti, **T. Farrar**, N. Frew, G. Gerbi, C. Helmis, T. Hristov, D. Khelif, A. Jessup, H. Jonsson, M. Li, L. Mahrt, W. McGillis, A. Plueddemann, L. Shen, E. Skillingstad, T. Stanton, P. Sullivan, J. Sun, J. Trowbridge, D. Vickers, S. Wang, Q. Wang, R. Weller, J. Wilkin, D. Yu, and C. Zappa. 2007. The Coupled Boundary Layers and Air-Sea Transfer Experiment in Low Winds (CBLAST-LOW). *Bull. Am. Meteor. Soc.*, 88(3), 341-356.
- Farrar, J.T.**, Zappa, C.J., Weller, R.A., and Jessup, A.T. 2007. Sea surface temperature signatures of oceanic internal waves in low winds. *J. Geophys. Res.*, 112, C06014, doi:10.1029/2006JC003947.
- Farrar, J.T.** 2008. Observations of the dispersion characteristics and meridional sea-level structure of equatorial waves in the Pacific Ocean. *J. Phys. Oceanogr.*, 38, 1669-1689.
- Wells, A.J., Cenedese, C., **Farrar, J.T.** and Zappa, C.J. 2009. Variations in ocean surface temperature due to near-surface flow: Straining the cool skin layer. *J. Phys. Oceanogr.*, 39, 2685-2710.
- Jiang, H., **Farrar, J.T.**, Beardsley, R., Chen, R. and Chen, C. 2009. Zonal surface wind jets across the Red Sea due to mountain gap forcing along both sides of the Red Sea. *Geophys. Res. Lett.*, 36, L19605, doi:10.1029/2009GL040008.

Manuscripts in preparation

- Farrar, J.T.** and Weller, R.A. 2009. Temperature balance of the mixed layer at two sites in the eastern tropical Pacific Ocean.
- Farrar, J.T.** and Weller, R.A. 2009. Cloud signals and oceanic mesoscale variability near 10°N in the eastern tropical Pacific.
- Prytherch, J., **Farrar, J.T.** and Weller, R.A. 2009. Multi-year observations of the diurnal warm layer.

Other Publications

- Farrar, J.T.**, S. Lentz, J. Churchill, P. Bouchard, J. Smith, J. Kemp, J. Lord, G. Allsup, and D. Hosom. King Abdullah University of Science and Technology (KAUST) Mooring Deployment Cruise and Fieldwork Report. Technical report, Woods Hole Oceanographic Institution, 2009-XX, Woods Hole, MA. 88 pp.
- Whelan, S., J. Lord, N. Galbraith, R. Weller, **J.T. Farrar**, D. Grant, C. Grados, S. deSoeke, C. Moffat, C. Zappa, M. Yang, F. Straneo, C. Fairall, P. Zuidema, D. Wolfe, M. Miller, and D. Covert. Stratus 9/VOCALS, Ninth Setting of the Stratus Ocean Reference Station & VOCALS Regional Experiment. Technical report, Woods Hole Oceanographic Institution, 2009-03, Woods Hole, MA. 118 pp.
- Whelan, S., Lord, J., Grados, C., Yu, L., Morales, L., Galbraith, N., deSoeke, S. O'Leary, M., Weller, R., Bouchard, P., **Farrar, T.**, and Bradley, F. Stratus Ocean Reference Station (20°S, 85°W) mooring recovery and deployment cruise STRATUS 8 R/V Ronald H. Brown cruise 07-09 October 9, 2007-November 6, 2007. 2007. Technical report, Woods Hole Oceanographic Institution, 2008-01, Woods Hole, MA. 110 pp.
- Hutto, L., **Farrar, T.**, and Weller, R. CBLAST 2003 Field Work Report. 2005. Technical report, Woods Hole Oceanographic Institution, 2005-04, Woods Hole, MA. 134 pp.
- Farrar, J.T.** and Weller, R. Where the trade winds meet: air-sea coupling in the inter-tropical convergence zone. 2003. National Oceanic and Atmospheric Administration, Office of Oceanic and Atmospheric Research "In the spotlight" internet article (7-14-2003). http://www.oar.noaa.gov/spotlite/archive/spot_pacs.html

Selected Presentations

Conference presentations (presenting author only)

Farrar, J.T., R. Weller, and J. Edson. Observations of the coupled air-sea boundary layers during the 2003 CBLAST-Low field program. *Eos Trans. AGU*, 84(52), Ocean Sci. Meet. Suppl., Abstract OS51G-02, 2004. (Invited)

Farrar, J.T. and Weller, R.A. The evolution of upper ocean thermal structure at 10°N, 125°W during 1997-98. *Eos Trans. AGU*, 84(52), Ocean Sci. Meet. Suppl., Abstract OS22E-12, 2004.

Farrar, J.T., Plueddemann, A J, and Weller, R.A. Evaluation of a kinetic energy budget for inertial motions in the oceanic mixed layer: theory and observations. *Eos Trans. AGU*, 84(52), Ocean Sci. Meet. Suppl., Abstract OS22E-01, 2004.

Farrar, J.T., Weller, R.A., and Huang, K. Comparison of NWP model/reanalysis air-sea fluxes of heat and momentum to in situ observations at several sites in the tropical Pacific. 1st International CLIVAR Science Conference. Baltimore, MD. 2004.

Farrar, J.T., Weller, R.A., Zappa, C., and Jessup, A.T. Subsurface expressions of sea surface temperature variability under low winds, in *16th Symposium on Boundary Layers and Turbulence (AMS)*, Ref. P8.1, Portland, ME. 2004.

Farrar, J.T. and Weller, R.A. Air-sea heat fluxes and SST at two sites in the eastern tropical Pacific during 1997-98. *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract A53B-06, 2005.

Farrar, J.T. and Weller, R.A. Intraseasonal variability near 10°N in the eastern tropical Pacific Ocean. *Eos Trans. AGU*, 87(36), Ocean Sci. Meet. Suppl., Abstract OS35H-13, 2006.

Plueddemann, A.J. and **Farrar, J.T.** Observations and models of the energy flux from the wind to mixed layer inertial currents. *Eos Trans. AGU*, 87(36), Ocean Sci. Meet. Suppl., Abstract OS36A-28, 2006.

Farrar, J.T., Zappa, C.J., Weller, R.A., and Jessup, A.T. Sea surface temperature signatures of oceanic internal waves in low winds, in *27th Conference on Hurricanes and Tropical Meteorology (AMS)*, Ref. P11.2, Monterey, CA. 2006.

Farrar, J.T. and Weller, R.A. Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific. NOAA Climate Prediction Program for the Americas PI Meeting, August 2006, Tucson, AZ.

Farrar, J.T. and Weller, R.A. The relationship between oceanic mesoscale motions and atmospheric convection on 10°N in the eastern tropical Pacific Ocean. *EOS Trans. AGU*, 87(52), Fall Meet. Suppl., Abstract OS51E-06. 2006.

Weller, R.A., **Farrar, J.T.**, Zappa, C.J., and Jessup, A.T. Sea surface temperature signatures of oceanic internal waves in low winds. *EOS Trans. AGU*, 87(52), Fall Meet. Suppl., Abstract OS43D-07. 2006.

Farrar, J.T. Observations of the dispersion characteristics and meridional sea-level structure of Pacific equatorial waves. Ocean Sciences Meeting Abstract Book, p. 121. 2008.

Farrar, J.T. Air-sea exchange in the Red Sea: the role of coastal processes. Gordon Research Conference on Coastal Ocean Circulation, New London, NH. 2009. (Invited)

Farrar, J.T. Barotropic Rossby waves seen radiating from tropical instability waves in the Pacific Ocean. NASA Ocean Surface Topography Science Team Meeting, Seattle, WA. 2009.

Seminars

September 2006, Massachusetts Institute of Technology, Oceanography and Climate Sack Lunch Seminar. *Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific.*

February 2007 (Invited), National Data Buoy Center. *Buoys and wave-measurement requirements of the WHOI Upper Ocean Processes Group.*

April 2007 (Invited), Lamont-Doherty Earth Observatory, Ocean and Climate Physics Seminar. *Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific.*

June 2007 (Invited), Geophysical Fluid Dynamics Program Staff Lecture, Woods Hole Oceanographic Institution. *Modulation of the cool skin of the ocean by internal waves* (with C.J. Zappa and C. Cenedese).

July 2007 (Invited), Geophysical Fluid Dynamics Program, Mini-Symposium on "Ocean Bottom and Surface Boundary Layers", Woods Hole Oceanographic Institution. *The ocean's diurnal boundary layer: observations and models.*

October 2007, University of Oklahoma, Department of Meteorology, Seminar series in convection and numerical weather prediction. *Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific.*

October 2007 (Invited), University of Oklahoma, Department of Physics Colloquium Series. *Planetary-scale equatorial waves in the Pacific Ocean and mathematical analogy to the quantum simple harmonic oscillator.*

November 2007, Woods Hole Oceanographic Institution, Physical Oceanography Seminar. *Observations of equatorial waves in the Pacific Ocean: Dispersion characteristics, meridional sea-level structures, and a previously unobserved wave mode.*

November 2007 (Invited), Oregon State University, Physical Oceanography Seminar. *Observations of the dispersion characteristics and meridional sea-level structure of equatorial waves in the Pacific Ocean.*

November 2007, Oregon State University, Joint Physical Oceanography and Atmospheric Sciences Seminar. *Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific.*

April 2008, Woods Hole Oceanographic Institution, Physical Oceanography Seminar. *Equatorial and tropical instability waves: synthesis and new observations.*

June 2008, Oregon State University, Physical Oceanography Seminar. *Equatorial and tropical instability waves: synthesis and new observations.*

September 2009, Texas A&M University, Department of Atmospheric Sciences Seminar. *Oceanic mesoscale variability and atmospheric convection on 10°N in the eastern Pacific.*

September 2009 (Invited), Texas A&M University, Department of Oceanography Seminar. *Observations of the dispersion relation and meridional structure of equatorial waves and tropical instability waves.*

October 2009 (Invited), Woods Hole Oceanographic Institution, Applied Ocean Physics and Engineering Coastal Ocean Fluid Dynamics Laboratory Seminar. *Air-sea exchange in the Red Sea and the role of coastal processes.*

December 2009 (Invited), University of Rhode Island, Graduate School of Oceanography Seminar. *Observations of the dispersion relation and meridional structure of equatorial waves and tropical instability waves.*

Research Funding

A test mooring to develop wave measurement capabilities on WHOI buoys (work complete). Funding source: WHOI Access to the Sea. Co-PI: Robert Weller. This project involved adapting a wave-measurement package developed by the National Data Buoy Center for use on WHOI surface moorings and deployment of a test mooring south of Martha's Vineyard, MA where the response of the buoy to surface waves could be compared to independent measurements of surface waves.

Ensuring the success of future WHOI deep-ocean mooring deployments in harsh environments (work complete). Funding source: WHOI Access to the Sea. Co-PI: Robert Weller. We recovered the remnants of a failed surface mooring that was deployed in the Gulf Stream (as part of the CLIVAR Mode Water Dynamics Experiment) so that the failure mode could be identified and prevented.

KAUST- Coastal meteorological tower and air-sea interaction mooring (11/2007-10/2010). Funding source: King Abdullah University of Science and Technology of Saudi Arabia. Co-PI: Robert Weller. The proposal was to deploy a heavily-instrumented air-sea interaction mooring in the Red Sea and an instrumented meteorological tower on the coast. This is part of a larger effort to study the physics and biology of the Red Sea, and these measurements are being interpreted in conjunction with modeling and observational efforts by other PIs.

Moored observations of turbulent kinetic energy dissipation in and below the mixed layer during VOCALS (01/2008-12/2010). Funding source: NSF. Co-PIs: Christopher J. Zappa (LDEO) and Robert Weller. This project has equipped an existing, heavily-instrumented surface mooring with pulse-to-pulse-coherent Doppler sonar instruments to estimate dissipation of turbulent kinetic energy. Virtues of the approach are that the technique is insensitive to platform motion and that the deployment configuration should avoid measuring the turbulent wake of the mooring. If successful, the measurements will provide the longest time series of dissipation in the open ocean together with the complementary measurements needed to connect the dissipation to other physical processes.

Satellite and in situ observations of equatorially trapped waves (01/2008-12/2009). Funding source: Tropical Research Initiative of the WHOI Ocean Life Institute. Co-PI: Robert Weller. This effort will continue my work on Pacific equatorial waves, extending the analysis to higher frequencies and other oceans. Analysis will also address forcing of the waves and the relationship between equatorial waves and variations in satellite measurements of ocean color.

Formation of multiple zonal jets in the oceans (4/2009-03/2012). Funding source: NSF. Co-PIs: Igor Kamekovich and Pavel Berloff. This project involves study of "zonal jets", or zonally elongated features in mean properties, using theory, numerical modelling, and observation. My role on the project is to perform identical analyses of satellite sea-level observations and GCM output in an attempt to confirm or disprove the existence of the "jets" and test hypotheses about their dynamics.

Oceanic response to atmospheric forcing in the Kuroshio Extension (10/2008-09/2011). Funding source: NSF. Co-PIs: Luc Rainville, Nick Bond, Jae-Hun Park, Steven Jayne. This project will use data from the KESS experiment to study forcing and evolution of near-inertial waves in a strong mesoscale flow field.

Observations and analysis of deep equatorial variability in the Atlantic (3/2009-02/2013). Funding source: NSF. Co-PI: John Toole (and in collaboration with Peter Brandt, Carsten Eden, and Marcus Dengler of IFM-GEOMAR). An array of McLane Moored Profilers will be deployed in the equatorial Atlantic, and the data will be used to study deep equatorial waves and vertically-alternating zonal currents that have been observed in a pilot experiment and previous observations.

Professional Activities

Educational activities

2009: Advisor to two undergraduate summer students and one visiting graduate student.

2007: Co-advisor (with Dr. Claudia Cenedese) to Andrew Wells, a summer student fellow of the WHOI Geophysical Fluid Dynamics Program and graduate student in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge. This involved guiding and supervising Mr. Wells during his theoretical and laboratory study of the effect of surface divergence on the cool-skin effect.

2007: Delivered to undergraduate physics majors at the University of Oklahoma a presentation entitled "Physical oceanography, an alternative career pathway in physics".

2006, 2007, 2008: Guest lecturer for *Introduction to Physical Oceanography* (MIT-WHOI graduate course 12.808; Dr. James Price) on buoy-based measurement of surface meteorology.

2003-2006: Volunteered to mentor a student at Falmouth High School (MA) who was deemed at risk of dropping out of school or engaging in other self-destructive behavior. I met with the student weekly. In addition to providing personal and academic guidance, I fostered his interest in automotive repair.

2005: Hosted a field trip to WHOI by the Children's School of Science (Woods Hole, MA) meteorology class. This included a lecture on meteorological measurements at sea, discussion of students' design of an instrumented meteorological raft, and a tour of several laboratories at WHOI.

Service

Member of WHOI's Search Committee for Vice President of Marine Operations, 2008-2009

Member of WHOI's Diversity Committee, 2008-2010

WHOI Postdoctoral Association (Secretary), elected representative of the physical oceanography department, 2007-2008

Member of WHOI's Gender Equity Program Advisory Committee, 2004-2006

President, Sigma Pi Sigma (physics honor society), U. Oklahoma Chapter, 1999-2000

Reviewer for *Geophysical Research Letters*, *Journal of Physical Oceanography*, *Journal of Geophysical Research*, and *Ocean Science*

Proposal reviewer for UK Natural Environment Research Council (1 in 2009)

Proposal reviewer for National Science Foundation, OCE (3) and ATM (1) during August 2008 and February 2009 cycles

Membership in Professional Societies

American Geophysical Union, American Meteorological Society, American Association for the Advancement of Science

Field experience

2009: King Abdullah University for Science and Technology mooring recovery/redeployment cruise, SETE3 (tug) and SETE30 (barge); Durrat (Saudi Arabia) to Durrat (Red Sea). Chief Scientist.

2008: King Abdullah University for Science and Technology mooring deployment cruise, RV *Oceanus*; Jeddah (Saudi Arabia) to Jeddah. Chief Scientist.

2008: Northern Tropical Atlantic Station mooring turnaround cruise, RV *Oceanus*; Woods Hole, MA to Barbados. Chief Scientist: Al Plueddemann.

2007: CLIMODE and wave-measurement test mooring recovery cruise, RV *Oceanus* (Co-PI with Robert Weller). Participation in planning and execution of a dragging operation to retrieve remnants of a mooring that had previously failed in the Gulf Stream. Chief scientist: Robert Weller.

2007: Wave-measurement test mooring, RV *Oceanus* (Co-PI with Robert Weller). Chief Scientist for mooring deployment cruise in coastal waters south of Martha's Vineyard, MA.

2003: Coupled Boundary Layers and Air-Sea Transfer Experiment, Low Winds, FV *Nobska* (PI, Robert Weller). Chief Scientist for 3 of 5 cruise legs.

2001: Salt Finger Tracer Release Experiment, RV *Oceanus*; Barbados to Barbados. SF₆ tracer release and microstructure sampling, Chief Scientist: Raymond Schmitt.