

Curriculum Vitae

Z. A. Wang

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Zhaohui 'Aleck' Wang, PhD

Associate Scientist

Department of Marine Chemistry & Geochemistry

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Professional Experience

Woods Hole Oceanographic Institution	Associate Scientist	2013-Present
Woods Hole Oceanographic Institution	Assistant Scientist	2009-2013
University of South Florida	Postdoc/Research Associate Mentor: <u>Dr. Robert H. Byrne</u>	2003-2009
State Oceanic Administration of China	Project Manager	1994-1996

Education

1998 – 2003 Ph.D., Marine Science, University of Georgia, Athens, GA.

Advisor: Dr. Wei-Jun Cai, Department of Marine Science, University of Georgia.

Dissertation: Biogeochemical Changes of Chemical Signals in the Georgia "Land-to-Ocean Continuum"

1996 – 1998 M.Sc., Oceanography, University of New Hampshire, Durham, NH.

Advisor: Dr. Theodore C. Loder III, Department of Earth Sciences, University of New Hampshire, Durham, NH.

Thesis: The Annual and Seasonal Variations of Nitrogen in Massachusetts Bay

1990 – 1994 Marine Chemistry, Xiamen University, Xiamen, China

Professional Affiliations

Member, American Geophysical Union

Member, American Society of Limnology and Oceanography

Member, American Chemical Society

Research Interests

Carbonate chemistry; Ocean acidification; Coastal and wetland inorganic carbon cycle; Riverine CO₂ systems

Sensing technologies and in-situ sensors for measurements of the aquatic CO₂ system (pH, pCO₂/fCO₂, dissolved inorganic carbon, and total alkalinity), nutrients, and metals

Professional and Synergistic Activities

Session Chair. Carbon Cycling and Fluxes in Coastal Vegetated Wetlands. 2014 Joint Aquatic Sciences Meeting. Portland, OR. May 18-23, 2014.

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Session Co-chair. The Carbonate System Chemistry of Coastal Ecosystems: Physical, Chemical and Biological Drivers. 2013 AGU Fall Meeting. San Francisco, CA. Dec. 09-13, 2013.

Panelist for the Northeast Coastal Acidification Network (NECAN), 2013-2014

WHOI Representative (alternate) for the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) Board, 2012 – present.

Group leader: East coast CO₂ flux group, U.S. East Coast Carbon Cycle Synthesis Workshop, Ocean Carbon Biogeochemistry (OCB) and North America Carbon Program (NACP). January 19-20, 2012.

Member for Ocean Observatories Initiative instrument selection board, Consortium for Ocean Leadership, 2011

Instructor: Ocean Acidification Short Course (OCB sponsored), Woods Hole, MA. November 2009.

Journal reviewer: Environmental Science and Technology; The ISME Journal; Marine Chemistry; Limnology and Oceanography Method; Deep Sea Research; Proceedings of the Royal Society B (Biological Sciences); Continental Shelf Research; Biogeosciences; Aquatic Geochemistry; Journal of Marine Systems; Journal of Geophysical Research; Method in Oceanography

Proposal reviewer: NSF, DOE, NOAA

Awards

2003: Dissertations Symposium on Chemical Oceanography (DISCO XVIII) Invited Participant

2003: Dissertation Completion Assistantships, University of Georgia

2002: Student Travel Grant Award, American Geophysical Union

1996 – 1998: Departmental Tuition Scholarship, Department of Earth Science, University of New Hampshire.

Papers in Peer-Reviewed Journals

(* Students, postdocs, visiting scholars)

McGillis, W., Hsueh, D., Zheng, Y., Markowitz, M., Fevrin, F., Noel, W. Thys, J.E., Paine, J. **Wang, Z.A.**, Hoering, K.A., Hakimdavar, R., and Culligan, P.J. Carbon transport in rivers of southern Haiti. *Journal of Applied Geochemistry* (in review).

Gledhill, D. et al. (more than 15 authors). Ocean and coastal acidification off New England and Nova Scotia: The state of the science. *Oceanography* (in review).

Maas, A.E.*, **Z.A. Wang**, and Lawson, G.L. The metabolic response of Thecosome pteropods from the North Atlantic and North Pacific Oceans to the interactive stressors of high CO₂ and low O₂. *Journal of Experimental Biology* (in revision).

- Wang, Z. A.**, Sonnichsen F.N., Bradley, A.M., Hoering, H.A., Lanagan, T.M., Chu, S.N., Hammar, T.R., and Camilli, R. 2015. An in-situ sensor technology for simultaneous spectrophotometric measurements of seawater total dissolved inorganic carbon and pH. *Environmental Science & Technology*. doi: 10.1021/es504893n.
- Mann, P. J., Spencer, R. G. M., Biennu, D. J. , Poulsen, J. R., Hernes, P. J., Fiske, G., Salter, M. E., **Wang, Z. A.**, Hoering, K. A., Six, J., Holmes, R. M. 2014. The biogeochemistry of carbon across a gradient of streams and rivers within the Congo Basin. *J. Geophys. Res. – Biogeosciences*. doi:10.1002/2013JG002442.
- Voss, B.M.*, Peucker-Ehrenbrink, B., Eglinton, T.I., Fiske, G., **Wang, Z.A.**, Hoering, K.A., Montluçon, D.B., LeCroy, C., Pal, S., Marsh, S., Gillies, S.L., Janmaat, A., Bennett, M., Downey, B., Fanslau, J., Fraser, H., Macklam-Harron, G., Martinec, M., and Wiebe, B. 2014. Tracing river chemistry in space and time: Dissolved inorganic constituents of the Fraser River, Canada. *Geochimica et Cosmochimica Acta*, 124, 283–308. doi: 10.1016/j.gca.2013.09.006.
- Signorini S. R., Mannino, A., Friedrichs, M., Najjar, R., Xue, J., Cai, W-J, Salisbury, J., and **Wang, Z.A.** Thomas, H., and Shadwick, E. 2013. Surface ocean $p\text{CO}_2$ seasonality and sea-air CO_2 flux estimates for the North American east coast. *J. Geophys. Res. – Oceans* 118, 1–22. DOI:10.1002/jgrc.20369.
- Li, Q.*, Wang, F., **Wang, Z. A.**, Yuan, D., Dai, M., Chen, J., Dai, J. and Hoering, K. A. 2013. An automated spectrophotometric analyzer for rapid single-point titration of seawater total alkalinity. 2013. *Environmental Science & Technology*. DOI: 10.1021/es402421a.
- Wang, Z. A.**, Chu, S. N. and Hoering, H. A. 2013c. High-frequency spectrophotometric measurements of total dissolved inorganic carbon in seawater. *Environmental Science and Technology* 47: 7840–7847. DOI: 10.1021/es400567k.
- Wang, Z. A.**, D. J. Biennu, P. J. Mann, H.A. Hoering, J. R. Poulsen, R. G. M. Spencer, and R. M. Holmes. 2013b. Inorganic carbon speciation and fluxes in the Congo River. *Geophys. Res. Lett.* 40: 1 – 6. DOI:10.1002/grl.50160
- Wang, Z. A.**, Wanninkhof, R., Cai, W.-J., Byrne, R.H., Hu, X., Peng, T.-H., Huang, W.J. 2013a. The marine inorganic carbon system along the Gulf of Mexico and Atlantic coasts of the United States: Insights from a transregional coastal carbon study. *Limnology and Oceanography* 58 (1): 325-342. DOI:10.4319/lo.2013.58.1.0325
- Wang, Z. A.**, Liu, X., Byrne, R. H., Wanninkhof, R. H., Bernstein, R. E., Kaltenbacher, E. A., Patten, J. 2007. Simultaneous spectrophotometric flow-through measurements of pH, carbon dioxide fugacity, and total inorganic carbon in seawater. *Analytica Chimica Acta*, 596: 23-36.
- John, D. E., **Wang, Z. A.**, Liu, X., Byrne, R. H., Corredor, J. E., López, J. M., Cabrera, A., Bronk, D. A., Tabita, F. R., Paul, J. P. 2007. Phytoplankton carbon fixation gene (RuBisCO) transcripts and air-sea CO_2 flux in the Mississippi River plume. *The ISME Journal*: 1-15.
- Liu, X., **Wang, Z. A.**, Byrne, R. H., Kaltenbacher, E., Bernstein, R. E. 2006. Spectrophotometric measurements of pH in-situ: laboratory and field evaluations of instrumental performance. *Environ. Sci. Technol.*: 40, 5036-5044.

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- Wang, Z. A.**, Cai, W. J., Wang, Y., Ji, H. 2005. The southeastern continental shelf of the United States as an atmospheric CO₂ source and an exporter of inorganic carbon to the ocean. *Continental Shelf Research*, 25: 1917-1941.
- Zhai, W., Dai, M., Cai, W., Wang, Y., **Wang, Z. A.** 2005. High partial pressure of CO₂ and its maintaining mechanism in a subtropical estuary: the Pearl River estuary, China. *Mar. Chem.*, 93: 21-32.
- Wang, Z. A.**, Cai, W. J. 2004. Carbon dioxide degassing and inorganic carbon export from a marsh-dominated estuary (the Duplin River): a marsh CO₂ pump. *Limnol. Oceanogr.*, 49: 341-354.
- Cai, W. J., Dai, M., Wang, Y., Zhai, W., Huang, T., Chen, S., Zhang, F., Chen, Z., **Wang, Z. A.** 2004. The biogeochemistry of inorganic carbon and nutrients in the Pearl River estuary and the adjacent Northern South China Sea. *Continental Shelf Research*, 24: 1301-1319.
- Cai, W. J., **Wang, Z. A.**, Wang, Y. 2003. The role of marsh-dominated heterotrophic continental margins in transport of CO₂ between the atmosphere, the land-sea interface and the ocean. *Geophys. Res. Lett.*, 30: 1849.
- Wang, Z. A.**, Cai, W. J., Wang, Y., Upchurch, B. L. 2003. A long pathlength liquid-core waveguide sensor for real-time pCO₂ measurements at sea. *Mar. Chem.*, 84: 73 – 84.
- Wang, Z. A.**, Wang, Y. C., Cai, W. J., Liu, S. Y. 2002. A long pathlength spectrophotometric pCO₂ sensor using a gas-permeable liquid-core waveguide. *Talanta*, 57: 69-80.

Other Publications

- Wang, Z. A.**, Cahill, B., Cai, W.-J., Fennel, K., Friedrichs, M., McGillis, W., Salisbury, J., Schaaf, C., Signorini, S. 2012. Air-sea exchange. Najjar, R.G., Friedrichs, M., Cai, W.-J. (Editors), Report of the U.S. East Coast Carbon Cycle Synthesis Workshop, January 19-20, 2012. pp. 10-11.
- Wang, Z.A.**; Byrne, R.H. 2010. Summer-time CO₂ fluxes and carbonate system behavior in the Mississippi River and Orinoco River Plumes in *Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Annex)*, Venice, Italy, 21-25 September 2009, Hall, J., Harrison, D.E. & Stammer, D., Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.

Invited Lectures

- The U.S. Northeast Coast: A Coastal Ocean Acidification Sensitive Region. Workshop “Latitude 41 under Siege: Impact of Nutrient Pollution & OA on Coastal Waters, Estuaries and Marine Life”, University of Connecticut Avery Point, CT. February 12, 2015.
- The Paradox of Salt Marshes as a Source of Alkalinity and Low pH, High Carbon Dioxide Water to the Ocean. The 2nd Xiamen Symposium on Marine Environmental Sciences. Xiamen, China. January 07 – 09, 2015.

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High-frequency spectrophotometric measurements of seawater CO₂ system parameters – The need, development, and potential application. The 2nd Seafloor Observation Symposium of China. Xiamen, China. November 08 – 10, 2014.

Thousands of Miles of Carbonate Chemistry. Ocean University of China. September 2014.

The marine CO₂ system in the Northeast Coast of the United States: Ocean Acidification and Controlling Processes. University of Massachusetts Boston. April 2014.

Ocean Acidification of the Shelf Waters of NECAN: The marine inorganic carbon system along the Atlantic and Gulf of Mexico coasts of the United States. November 2013. Northeastern Regional Association of Coastal and Ocean Observing Systems (NARACOOS) Webinar Series.

Towards a Better Understanding of Changes and Drivers of the CO₂ System in Aquatic Environments. June 2013. College of Chemistry and Chemical Engineering, Ocean University of China. Qingdao, China.

Real-time Measurements of the Marine CO₂ System. June 2013. Shandong Institute of Marine Instruments. Qingdao, China.

The Marine Inorganic Carbon System along the Gulf of Mexico and Atlantic Coasts of the United States. December 2011. School of Marine Science, University of Maine. Orono, ME.

Coastal CO₂ System: From Sensor Development to Observational Studies. December 2010. The Second Institute of Oceanography, State Oceanic Administration of China. Hangzhou, China.

Distributions of the CO₂ System along the US Atlantic and Gulf of Mexico Coast. December, 2010. State Key Laboratory of Estuarine and Coastal Research, East China Normal University. Shanghai, China.

Inorganic carbon fluxes in rivers and coastal oceans. December, 2010. College of Chemistry and Chemical Engineering, Ocean University of China. Qingdao, China.

Coastal CO₂ System: From Sensor Development to Observational Studies. April 2010. Departmental Seminar, Department of Oceanography, Dalhousie University, Canada.

Coastal CO₂ System: From Instrumentation to Observation. March 2010. MIT EAPS Weekly Seminar, Boston, MA.

Seminars at WHOI

High-frequency spectrophotometric measurements of seawater CO₂ system parameters. May 2014. WHOI Applied Ocean Physics and Engineering Weekly Seminar, Woods Hole, MA.

The Marine Inorganic Carbon System along the Gulf of Mexico and Atlantic Coasts of the United States: Latitudinal trends, Mixing, and Shelf-ocean exchange. March 2012. Marine Chemistry and Geochemistry Seminar, WHOI, Woods Hole, MA.

Temporal and Spatial Variabilities of the Inorganic Carbon System in the Mackenzie River and Beyond. October 2011. Global River Workshop, Woods Hole, MA.

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Spatial variations of the riverine carbonate system in Mackenzie River. October 2010. ETBC River Workshop. Woods Hole, MA.

Riverine DIC Fluxes and Coastal CO₂ System. July 2010. WHOI AOP&E Weekly Seminar, Woods Hole, MA.

Distributions of the CO₂ System along the US Atlantic and Gulf of Mexico Coast - Data from Gulf of Mexico and East Coast Carbon Cruise (GOMECC). April 2010. WHOI Biology Weekly Seminar, Woods Hole, MA.

Simultaneous Spectrophotometric Measurements of the CO₂ System Parameters in Seawater. October 2009. AOP&E Seminar, WHOI, Woods Hole, MA.

Supervision and Mentoring

Postdoc mentoring (co-mentoring with B. Peucker-Ehrenbrink and V. Galy):

Dr. Kristina Brown, 2014 – present

Student mentoring:

Sophie Chu, WHOI-MIT Joint Program student, 2011 – present

WHOI Summer Student Fellow (2011): Jacinta Edebeli

WHOI Summer Student Fellow (2013): Alterra Sanchez

Visiting Scholar:

Dr. Quanlong Li, Xiamen University, China. 2011-2012

Dr. Peisong Yu, Second Institute of Oceanography, State Oceanic Administration of China, 2014 – present

Lab Personnel: Katherine Hoering, Research Assistant III, 2010-present

Guest Students:

Charles Zhu, Yale University, 2010

Cris Luttazi, Kingston University, 2010, 2011

Mohammad M. Uddin, University of New Hampshire, 2011

Kelly Knorr, University of Rhode Island, 2012

Robert "Nick" Tuttle, Drexel University, 2012

Yujuan Zhou, Ocean University of China, 2012

Yue Qiu, Oberlin College, 2013

Lenna Quackenbush, Worcester Polytechnic Institute, 2013

Dmitro Martynowych, Scranton University, 2014

Juliette Parmenter, Meridian Academy, 2014

Selected Conference Papers and Abstracts

Wang, Z.A., Chu, S.N., Kroeger, K.D, Hoering, K.A., Gonnee, M.E. 2015. The Paradox of Salt Marshes as a Source of Alkalinity and Low pH, High Carbon Dioxide Water to the Ocean. ASLO Aquatic Sciences Meeting. February 22 – 27, 2015. Granada, Spain.

Chu, S.N., **Wang, Z.A.**, Sonnichsen, F.N., Bradley, A.M., Hoering, K.A., Lanagan, T.M., Hammar, T.R., Camilli, R. 2015. A high resolution, in situ sensor to simultaneously measure total dissolved inorganic carbon and pH in aquatic environments. ASLO Aquatic Sciences Meeting. February 22 – 27, 2015. Granada, Spain.

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- Wang, Z.A.**, Kroeger, K.D., Green, A., Hoering, K.A., Pohlman, J.W., Ganju, N., Moseman-Valtierra, S., Tang, J. 2014. Salt Marsh Carbon Budgets: Biogeochemistry of the CO₂ System and Tidal Exchanges of Inorganic Carbon. Joint Aquatic Sciences Meeting. May 18-23, 2014. Portland, OR.
- Kroeger, K.D., Pohlman, J.W., Ganju, N., Spivak, A., **Wang, Z.A.**, Green, A., Brooks, T.W., Baldwin, S., Moseman-Valtierra, S., Tang, J. 2014. Salt Marsh Carbon Budgets: The Role of Tidal Exchanges of Dissolved and Particulate Organic Carbon. Joint Aquatic Sciences Meeting. May 18-23, 2014. Portland, OR.
- Wang, Z.A.**, Sonnichsen, F.N., Hoering, K.A., Chu, S.N. 2014. A Buoy-based Sensor Technology for Simultaneous, In-situ Measurements of Seawater pH and Total Dissolved Inorganic Carbon. 2014 Ocean Sciences Meeting. Feb. 23-28, 2014. Honolulu, HI.
- Chu, S.N., **Wang, Z.A.**, and Hoering, K.A., Lawson, G.L. 2014. Anthropogenic Carbon Increase in the Northeast Pacific Over the Past Decade. 2014 Ocean Sciences Meeting. Feb. 23-28, 2014. Honolulu, HI.
- Sanchez, A., Signell, J., **Wang, Z.A.**, Kroeger, K.D. 2014. Calibration of a CO₂ and pH Sensor: Enabling the Measurement of Blue Carbon Flux. 2014 Ocean Sciences Meeting. Feb. 23-28, 2014. Honolulu, HI.
- Wang, Z. A.**, Pilskalns, C. H., Maas, A., Hayashi, K., Lawson, G. L. 2013. Coastal Ocean Acidification in the Gulf of Maine: Potential Drivers and Impacts. Ocean Acidification PI Workshop. Sept 18 - 20, 2013. Washington DC.
- Lawson, G.L., **Wang, Z. A.**, Wiebe, P. E., Lavery, A. C., Copley, N. J., Chu, S., Hoering, K. A. 2013. Ocean Acidification and Pteropods in the Northwest Atlantic and Northeast Pacific. Ocean Acidification PI Workshop. Sept 18 - 20, 2013. Washington DC.
- Maas, A. E., Lawson, G. L., **Wang, Z. A.**, and Tarrant, A. M. 2013. 'RNA-seq'ing the Effects of CO₂ on Sea Butterflies: Physiology and Gene-expression Studies of Thecosome Pteropods. Ocean Acidification PI Workshop. Sept 18 - 20, 2013. Washington DC.
- Wang, Z. A.**, Wanninkhof, R., Cai, W. J., Byrne, R. H., Hu, X. P., Peng, T. H. and Huang, W. J. (2013). The Marine Inorganic Carbon System along the Gulf of Mexico and Atlantic Coasts of the United States: Insights from a Transregional Coastal Carbon Study. 9th International Carbon Dioxide Conference. June 3-7, 2013. Beijing, China.
- Chu, S., **Wang, Z. A.**, Hoering, K. Ocean Acidification in the Northeast Pacific Oxygen Minimum Zone. ASLO 2013 Aquatic Sciences Meeting. February 17 – 22. New Orleans, LA, USA.
- Wang, Z.A.**, Hoering, H., Lawson, G. 2012. Ocean Acidification in the Northwest Atlantic between 2003 and 2011. Third International Symposium on the Ocean in a High CO₂ World, September 24-27, 2012. Monterey Bay, CA, USA.
- Maas, A.E., **Wang, Z.A.**, Lawson, G.L. 2012. Impact of Ocean Basin on Pteropod Exposure and Response to High CO₂ and Low O₂. Third International Symposium on the Ocean in a High CO₂ World, September 24-27, 2012. Monterey Bay, CA, USA.

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- Almeida, J.L. Ward, B., Shutler, J., Gentemann, C., **Wang, Z.A.**, Bresnahan, P.J. 2012. On the Inclusion of the Ocean's Diurnal Warming Effect for the Global Air-sea Net Budget Estimation. SOLAS Open Science Conference 2012, May 07 – 10, 2012. Cle Elum, WA, USA.
- Wang, Z.A.**, Hoering, K. 2012. Temporal and Spatial Variabilities of the Riverine Inorganic Carbon System in the Mackenzie River and Beyond. Ocean Science 2012, February 19 – 24, 2012. Salt Lake City, UT, USA.
- Hoering, K., **Wang, Z.A.**, Luttazi, C., Lawson, G. 2012. Direct Observation of Ocean Acidification in the Northwest Atlantic between 2003 and 2011. Ocean Sciences 2012, February 19 – 24, 2012. Salt Lake City, UT, USA.
- Edebeli, J., **Wang, Z.A.** 2012. Simplified Spectrophotometric Method for Measuring Sea Water Alkalinity. Ocean Science 2012, February 19 – 24, 2012. Salt Lake City, UT, USA.
- Wang, Z. A.**, Wanninkhof, R., Peng, T.-H., Cai, W.-J., Hu, X., Byrne, R.H. 2011. The Marine Inorganic Carbon System along the Gulf of Mexico and Atlantic Coast of the United States: Shelf-ocean exchange and Ocean Acidification Status. AGU Fall Meeting 2011, December 5 – 9, 2011. San Francisco, CA, USA.
- Wang, Z. A.**, Wanninkhof, R., Cai, W.-J., Hu, X., Peng, T.-H., Byrne, R.H. 2010. Distributions of the CO₂ System along the US Atlantic and Gulf of Mexico Coast. Ocean Science 2010, February 22 – 26, 2012. Portland, OR, USA.
- Wang, Z. A.**, Byrne, R. H. 2008. Summer-time CO₂ Fluxes and Carbon System Behavior in the Mississippi River and Orinoco River Plumes. Ocean Science 2008, March 02 – 07, 2008. Orlando, FL, USA.
- Wang, Z. A.**, Wiebe, W. J., Cai, W. J. and Sheldon, J. 2002. Distributions and fluxes of inorganic nitrogen in the five Georgia river estuaries of the Southeastern United States: river flow control vs. intertidal marsh effect. Ocean Sciences Meeting, Honolulu, HI. See abstract in EOS. Trans. AGU, 83(4), Ocean Sciences Meet. Suppl., Abstract OS21P-10, 2002.
- Wang, Z. A.**, Wang, Y., Cai, W. J. 2002. Spectrophotometric *p*CO₂ measurements based on a long pathlength liquid-core waveguide in the South Atlantic Bight. Ocean Sciences Meeting, Honolulu, HI. See abstract in EOS. Trans. AGU, 83(4), Ocean Sciences Meet. Suppl., Abstract OS12A-121, 2002.
- Wang, Y., Zhai, W., **Wang, Z.**, Lu, Z., Dai, M., Cai., W. 2002. Biogeochemical studies of carbon in the South China Sea. Ocean Sciences Meeting, Honolulu, HI. See abstract in EOS. Trans. AGU, 83(4), Ocean Sciences Meet. Suppl., Abstract OS11C-35, 2002.
- Dai, M., Zhai, W., Cai, W., Huang, T., **Wang, Z.**, Huang, B., Callahan, J., Li, X., Lu, Z., Xu, X., Lin, X., Zhang, F., Ruan, W., Shang, S., Wang, Y., Qu, L., Hong, H. 2002. Biogeochemical response to a river plume induced phytoplankton bloom in the Pearl River Estuary, South China Sea. See abstract in EOS. Trans. AGU, 83(4), Ocean Sciences Meet. Suppl., Abstract OS11C-36, 2002.

Selected Expeditions and Cruises

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May – Oct, 2013, Three seasonal cruises in the Gulf of Maine. Ocean acidification: Are Deep Waters of the Gulf of Maine Already Corrosive to Pteropods? PI and Chief Scientist.

Aug 09 – Sept 18, 2012. Newport, OR – Los Angeles, CA; R/V New Horizon, North Pacific. Ocean acidification: Horizontal and Vertical Distribution of Thecosome Pteropods in Relation to Carbonate Chemistry in the Northwest Atlantic and Northeast Pacific. Co-PI, lead chemistry team.

Aug 07 – Sept 01, 2011. Woods Hole, MA – Woods Hole, MA; R/V Oceanus, North Atlantic. Ocean acidification: Horizontal and Vertical Distribution of Thecosome Pteropods in Relation to Carbonate Chemistry in the Northwest Atlantic and Northeast Pacific. Co-PI, Chemistry team leader.

July 10 – August 04, 2007: Galveston, TX – Boston, MA; R/V Ronald H. Brown; Gulf of Mexico and East Coast Carbon (GOMECC) cruise.

March 10 – 30, 2006: Honolulu, HI – Kodiak, AK, USA; R/V Thomas G. Thompson; NOAA CLIVAR/CO2 Repeat Hydrography P16N Cruise Leg-2 in the North Pacific Ocean.

January 11 – February 24, 2005: Punta Arenas, Chile - Fortaleza, Brazil; R/V Ronald H. Brown; NOAA CLIVAR/CO2 Repeat Hydrography A16S Cruise in the South Atlantic Ocean.