Matthew B. Alkire, Ph.D.

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EDUCATION

- Ph.D. Oceanography (2010), Oregon State University. Dissertation: *Freshwater Contributions and their Variability to the Surface and Halocline Layers of the Arctic and Subarctic seas*. Advisor: Dr. Kelly Falkner.
- M.S. Chemical Oceanography (2005), Florida Institute of Technology. Thesis: *Using Geochemical Tracers to Infer Flow Pathways and Mixing of Two Alaskan Arctic River Plumes Under Ice*. Advisor: Dr. John Trefry.
- B.S. Marine Science (2003), Richard Stockton College of New Jersey, *magna cum laude*. Minors in chemistry and mathematics. Advisor: Dr. Gordon Grguric.

EMPLOYMENT

- Senior Oceanographer (2011-present), Applied Physics Laboratory, University of Washington, Seattle, WA
- Postdoctoral Research Associate (2010-2011), Applied Physics Laboratory, University of Washington, Seattle, WA
- Teaching Assistant (2009-2010), College of Oceanic & Atmospheric Sciences, Oregon State University, Corvallis, OR
- Research Assistant (2006-2009), College of Oceanic & Atmospheric Sciences, Oregon State University, Corvallis, OR
- Research Assistant (2004-2005), Department of Marine & Environmental Systems, Florida Institute of Technology, Melbourne, FL
- Teaching Assistant (2003-2004), Department of Marine & Environmental Systems, Florida Institute of Technology, Melbourne, FL

AWARDS, GRANTS, and FELLOWSHIPS

- Changes of heat and freshwater budgets in the East Siberian Sea and southern Makarov Basin contributing to multidisciplinary changes in the Pacific Arctic (2015-2019), National Oceanic & Atmospheric Administration COM-Arctic Research Program, Grant NA15OAR4310156. Award: $170,739

- Collaborative Research: Assessing the Impact of Small, Canadian Arctic River Flows (SCARFs) to the Freshwater Budget of the Canadian Arctic Archipelago (2013-2017), National Science Foundation, Grant PLR-1303766. Award: $593,283

- Collaborative Research: Eurasian and Makarov Basins Observational Network Targets Changes in the Arctic Ocean (2012-2017), National Science Foundation, Grant PLR-1203146 AM003. Award: $669,901

- Using sea ice cores to investigate the influence of glacial meltwater in surface waters of Kongsfjorden (2012-2013), U.S.-Norway Fulbright Foundation for Educational Exchange, Host Institution: The University Centre in Svalbard. Amount: 87,000 NOK (approx. $15,100 USD)

- Eagle Scout (2000), Boy Scouts of America, Troop 1, Carlstadt, NJ

PROJECTS & FIELD WORK

- Assessing the impact of small, Canadian Arctic river flows (SCARFs) to the freshwater budget of the Canadian Archipelago (2014-2016). Role: Principle investigator. While the annual discharge of any given river is relatively small, the combined discharge of all rivers is sufficient to support nearshore, narrow boundary currents, which provide an important, but often neglected, transport mechanism. Thus, local contributions of freshwater may impact the total volume flux and geochemistry of the Canadian Arctic throughflow that has historically been attributed entirely to export from the Arctic Ocean. Characterizing the geochemical signature of local freshwater inputs is essential for distinguishing these contributions from those of Arctic Ocean origin, but virtually no studies have sampled small Arctic rivers discharging into the CAA.

- Nansen and Amundsen Basin Observing System (2013-2017). Role: co-Principle investigator. Three cruises will be conducted every two years during August/September to collect extensive measurements along the Siberian continental shelf and slope between the Barents and East Siberian Seas. The program will incorporate oceanographic, chemical, and ice observations using moorings, repeated oceanographic sections, and Lagrangian drifters to compile a cohesive picture of the state and transformations of Atlantic Water in the Eurasian and Makarov Basins, with particular emphasis on (1) along-slope transport via boundary currents; (2) interaction between Atlantic water branches and shelf waters; and (3) indications of change in the upper ocean circulation. Primary responsibilities include the collection of seawater samples, deployment of O_2 and NO_3 sensors, geochemical analysis of samples, and interpretation of resulting data in order to quantitatively distinguish contributions of various water sources (including river runoff, sea ice melt, and brine) and their role in the formation and ventilation of Arctic halocline waters.

- North Pole Environmental Observatory (2006-2015). Role: Ph.D. student/co-Principle investigator. Aerial hydrographic surveys are conducted annually from an established ice camp to collect physical and chemical measurements from the Makarov and Amundsen Basins in order to detect rapid change in the circulation of the central Arctic Ocean and improve understanding on how the world's northernmost sea helps regulate global climate. Field work included deployment of a Seabird CTD-O_2 sensor package, in-situ ultraviolet spectrophotometer (ISUS) as well as collection and sub-sampling of seawater samples for various chemical analyses (nutrients, barium, stable oxygen isotopes, salinity, total alkalinity, dissolved oxygen). Additional responsibilities included analyses of samples and sensor data, quality assurance/quality control, and archival of all data sets for public dissemination.

- The Freshwater Switchyard of the Arctic Ocean (2012). Role: Field work participant. The quantity and sources of freshwater present in the region upstream of the Nares and Fram Straits undergoes significant variability in response to changes to sea ice and upper ocean circulation. Annual hydrographic surveys are conducted in this region, called the Freshwater Switchyard, to monitor these changes and link them to ongoing environmental changes in the Arctic Ocean. Responsibilities included deployment and calibration of a Seabird CTD-O_2 package and collection of seawater samples for subsequent chemical analysis at various stations in the Lincoln Sea. Additional duties included post-processing of sensor-derived oxygen data for quality assurance/quality control.

- North Atlantic Bloom Experiment (2010-2011). Role: Postdoctoral research associate. The phytoplankton of the North Atlantic bloom plays a major role in the uptake and sequestration of atmospheric carbon dioxide. Despite the magnitude and importance of this event, it has rarely been observed from start to finish due to the difficulty and expense of maintaining ship operations. In 2008, a collaborative experiment in the North Atlantic near Iceland was conducted to measure and characterize the spring bloom using autonomous platforms. Responsibilities primarily included analysis of biogeochemical sensor data (pCO_2, O_2, NO_3, particulate backscatter, and beam attenuation) from multiple platforms (ships, Lagrangian floats, and Seagliders) deployed throughout the experiment in order to characterize the temporal and spatial variability of the bloom and estimate net community production using coupled budgets of measured variables.

- Barium analysis for Arctic Synoptic Basin-wide Oceanography project (2006-2009). Role: Laboratory analyst. Analysis of seawater samples collected from the Laptev and East Siberian Seas for dissolved barium.

- Equatorial Pacific Iron Speciation (2005). Role: Cruise participant. Collection and analysis of trace metal clean samples for dissolved iron via voltammetry.

- Continuation of Arctic Nearshore Impact Monitoring in Development Area, Program Tasks 3 and 4, Prudhoe Bay, Alaska (2004-2005). Role: M.S. student.

Collection of river water and seawater samples during spring (ice cover) and summer (open water) seasons in Prudhoe Bay. Samples processed for nutrients, salinity, total suspended sediments, and major ions. Chemical signatures utilized to distinguish freshwater sources (sea ice meltwater, Sagavanirktok River, and Kuparuk River) and analyze spreading patterns to inform local authorities on the potential for propagation of oil spills both above and underneath sea ice.

- Port Valdez, AK Sediment Coring Program (2004). Role: M.S. Student. Collection and sub-sampling of sediment cores for trace metal analyses.

SYNERGISTIC ACTIVITIES

- Associate Editor, Deep-Sea Research I (2016-present)
- Science Communication Fellow (2011-2016)
  Pacific Science Center, Seattle, WA
- Proposal reviewer, National Science Foundation (2013-present)
- Journal reviewer, Journal of Geophysical Research, Progress in Oceanography, Continental Shelf Research, Deep-Sea Research, Journal of Oceanography (2007-present)
- Association of Polar Early Career Scientists member (2009-present)
- America Geophysical Union member (2003-present)

PUBLICATIONS

Submitted and in preparation

- Alkire, M.B., J. Morison, A. Schweiger, J. Zhang, M. Steele, C. Peralta-Ferriz, S. Dickinson (2017). A meteoric water budget for the Arctic Ocean*, Journal of Geophysical Research,* in review.

- Alkire, M.B., I. Polyakov, R. Rember, I.M. Ashik, V. Ivanov, and A.V. Pnyushkov (2017). Lower halocline water formation and modification, a comparison of physical and geochemical methods, manuscript in preparation.

- Alkire, M.B., A. Jacobson, G.O. Lehn, and R.W. Macdonald (2017). A geochemical survey of estuaries across the Canadian Arctic Archipelago, manuscript in preparation.

Peer-reviewed publications

- Polyakov, I.V., A.V. Pnyushkov, M. Alkire, I.M. Ashik, T. Baumann, E.C. Carmack, I. Goszczko, J. Guthrie, V.V. Ivanov, T. Kanzow, R. Krishfield, R. Kwok, A. Sundfjord, J. Morison, R. Rember, and A. Yulin (2017). Greater role for Atlantic inflows on sea-ice loss in the Eurasian Basin of the Arctic Ocean,

Science, doi:10.1126/science.aai8204.

- Alkire, M.B., A. Jacobson, G.O. Lehn, R.W. Macdonald, and M.W. Rossi (2017). On the geochemical heterogeneity of rivers draining into the straits and channels of the Canadian Arctic Archipelago, *Journal of Geophysical Research Biogeosciences*, doi:10.1002/2016JG003723.

- Alkire, M.B., J. Morison, and R. Andersen (2015). Variability and trends in the meteoric water, sea-ice melt, and Pacific water contributions to the central Arctic Ocean, 2000-2013, *Journal of Geophysical Research 120*, 1573-1598, doi:10.1002/2014JC010023.

- Alkire, M.B., F. Nilsen, E. Falck, J. Søreide, and T. Gabrielsen (2015). Tracing sources of freshwater contributions to first-year sea ice in Svalbard fjords, *Continental Shelf Research 101*, 85-97.

- Alkire, M.B., E. D'Asaro, C. Lee, M.J. Perry, I. Cetinic, N. Briggs, and A. Gray (2014). Net community production and export from Seaglider measurements in the North Atlantic after the spring bloom, *Journal of Geophysical Research 119*, doi:10.1002/2014JC010105.

- Jackson, J.M., C. Lique, M. Alkire, M. Steele, C.M. Lee, W.M. Smethie, and P. Schlosser (2014). On the waters upstream of Nares Strait, Arctic Ocean, from 1991-2012, *Continental Shelf Research 73*, 83-96.

- Morison, J., R. Kwok, C. Peralta-Ferriz, M. Alkire, I. Rigor, R. Andersen, and M. Steele (2012). Changes in Arctic Ocean circulation and freshwater measure with ICESat altimetry, GRACE gravimetry, and *in situ* observations, *Nature 481:* doi:10.1038/nature10705.

- Alkire, M.B., E. D'Asaro, C. Lee, M.J. Perry, A. Gray, I. Cetinic, N. Briggs, E. Rehm, E. Kallin, J. Kaiser, and A. Gonzalez-Posada (2012). Estimates of net community production and export using high-resolution, Lagrangian measurements of O_2, NO_3^-, and POC through the evolution of a spring diatom bloom in the North Atlantic, *Deep-Sea Research I, 64:* 157-174.

- Alkire, M.B., K.K. Falkner, T. Boyd, and R.W. Macdonald (2010). Sea-ice melt and meteoric water distributions in Baffin Bay and the Canadian Arctic archipelago, *Journal of Marine Research 68(6)*: 767-798.

- Alkire, M.B., K.K. Falkner, J. Morison, R.W. Collier, C.K. Guay, R.A. Desiderio, I.G. Rigor, and M. McPhee (2010). Sensor-based profiles of the NO parameter in the central Arctic and southern Canada Basin: new insights regarding the cold halocline, *Deep-Sea Research I 57:* 1432-1443.

- McPhee, M., J. Morison, A. Proshutinsky, M. Steele, and M. Alkire (2009). Rapid change in freshwater content of the Arctic Ocean, *Geophysical Research Letters* 36: doi:10.1029/2009GL037525.

- Abrahamsen, E.P., M.P. Meredith, K.K. Falkner, S. Torres-Valdes, M.J. Leng, M.B. Alkire, S. Bacon, I. Polyakov, V. Ivanov, and S. Kirillov (2009). Tracer-derived freshwater budget of the Siberian Continental Shelf following the extreme Arctic summer of 2007, *Geophysical Research Letters 36*: doi:10.1029/2009GL037341.

- Alkire, M.B., K.K. Falkner, I. Rigor, M. Steele, and J. Morison (2007). The return of Pacific waters to the upper layers of the central Arctic Ocean, *Deep-Sea Research I 54*: 1509-1529.

- Alkire, M.B., and J.H. Trefry (2006). Transport of spring floodwater from rivers under ice to the Alaskan Beaufort Sea, *Journal of Geophysical Research 111*: doi:10.1029/2005JC003446.

Popular articles

- Morison, J., J. Wilkinson, M. Alkire, F. Nilsen, I. Polyakov, W. Smethie Jr, P. Schlosser, F. Vivier, A. Lourenco, C. Provost, J. Pelon, C. Peralta Ferriz, M. Karcher, B. Rabe, C. Lee (2017). The North Pole Region as an Indicator of the Changing Arctic Ocean: The Need for Sustaining Observations, *Arctic*, in press.

- Alkire, M.B., A. D. Jacobson, G.O Lehn, and R.W. Macdonald (2015). Small rivers could have big impact on Arctic Ocean, *Eos* 96, doi:10.1029/2015EO034005.

- Alkire, M.B., M.J. Perry, E. D'Asaro, and C.M. Lee (2013). Using sensor-based, geochemical measurements from autonomous platforms to estimate biological production and export of carbon during the 2008 North Atlantic spring bloom, *Ocean Carbon and Biogeochemistry News 6(2)*, 1-6.

Selected Abstracts

- Alkire, M.B., A. Jacobson, G. Lehn, R. Macdonald, and M. Rossi (2016). Geochemical heterogeneity of rivers draining the Canadian Arctic Archipelago, Eos, Trans. AGU, Fall Meet. Suppl., Abstract B13C-0577.

- (INVITED) Alkire, M.B., J. Morison, and I. Rigor (2014). Connecting changes in the inventories of Pacific water, meteoric water, and sea ice melt in the central Arctic and Fram Strait, 1998-2011, Eos, Trans. AGU, Ocean Sci. Meet. Suppl., Abstract ID 13657.

- Alkire, M.B., E. D'Asaro, C. Lee, M.J. Perry, A. Gray, I. Cetinic, N. Briggs, E. Rehm, J. Kaiser, and A. Gonzalez-Posada (2012). Estimates of net community

production and export via Lagrangian measurements of O_2, NO_3, and POC through the evolution of a spring bloom, Eos, Trans. AGU, Ocean Sci. Meet. Suppl., Abstract S085-9644.

- Alkire, M.B., K.K. Falkner, J. Morison, R.A. Desiderio, C. Guay, R.W. Collier, and M. McPhee (2010). The First Sensor-Based Measurements of the NO Parameter in the Arctic Ocean, Eos. Trans. AGU, 91(26), Ocean Sci. Meet. Suppl., Abstract PO45C-11.

- Abrahamsen, E.P., M.P. Meredith, K.K. Falkner, S. Torres-Valdes, M.J. Leng, M.B. Alkire, S. Bacon, S. Laxon, I. Polyakov, V. Ivanov (2010). Tracer-derived freshwater composition of the Siberian continental shelf and slope, Eos. Trans. AGU, 91(26), Ocean Sci. Meet. Suppl., Abstract PO35G-06.

- Alkire, M.B., K.K. Falkner, R.W. Collier, J. Morison, and C. Guay (2008). River runoff is the dominant source of freshwater to the central Arctic Ocean and Beaufort Sea during spring 2008, Eos. Trans. AGU, 89(53), Fall Meet. Suppl., Abstract C51A-0523.

- Alkire, M.B., K.K. Falkner, R.W. Collier, R. Desiderio, R. Andersen, and J. Morison (2008). The use of continuous profiles of oxygen and nitrate to assess the sources of halocline waters in the central Arctic Ocean, Eos. Trans. AGU, Ocean Sci. Meet. Suppl., Abstract 034-2027.

- Alkire, M.B., K.K. Falkner, R.W. Collier, R. Desiderio, R. Andersen, and J. Morison (2008). Investigating halocline water ventilation in the central Arctic Ocean using high-resolution O_2 and NO_3 measurements, Scientific Committee on Antarctic Research/International Arctic Science Committee, International Polar Year Open Science Conference, St. Petersburg, Russia.

- Morison, J.H., M. Steele, J. Wahr, M. Alkire, C. Peralta-Ferriz, R. Kwok, and T. Kikuchi (2007). A 2006-2007 Update on Oceanographic Conditions in the Central Arctic Ocean, Eos Trans. AGU, 88(52), Fall Meet. Suppl., Abstract U41C-0619.