

Christopher T. Hayes

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Education

PhD, MPhil, MA **Columbia University** | New York, NY, 2013–2008
Earth and Environmental Science

BSc **McGill University** | Montreal, QC, 2008–2004
Chemistry (Environmental)

Professional Experience

2016–present *Assistant Professor*
Department of Marine Science
University of Southern Mississippi | Stennis Space Center, MS

2013–2015 *W.O. Crosby Postdoctoral Fellow*
Department of Earth, Atmospheric and Planetary Science
Massachusetts Institute of Technology | Cambridge, MA

2008–2013 *Graduate Research and Teaching Assistant*
Department of Earth and Environmental Science
Lamont-Doherty Earth Observatory
Columbia University | New York, NY

Non-exhaustive List of Awards and Accomplishments

W.O. Crosby Postdoctoral Fellowship, 2013–2015
NOAA Climate and Global Change Postdoctoral Fellowship, 2013 (declined)
Best Student Oral Presentation, R. Duce Symposium, AMS Meeting 2013
Gary Comer Abrupt Climate Change Fellow, 2010
Faculty Fellow, Columbia University, 2008–2013

Non-exhaustive List of Courses Taught

Isotope Biogeochemistry (USM, MAR642, 3 credit hours, yearly)
Paleoceanography (USM, MAR683, 3 credit hours, yearly)
The Oceans and Climate (USM, MAR491a, 3 credit hours, odd-years)
Marine Pollution (USM, MAR491b, 3 credit hours, even-years)

Pedagogical Development

Kaufman Teaching Certificate Program (MIT, Spring 2015)

Student Mentoring

Samuel Glasscock, MS advisor (USM)	2016–present
Laura Whitmore, PhD committee member (USM)	2015–present
Haley Anderson, MS co-advisor (USM)	2016–present
Jeffrey Rosen & Ashling Neary, Undergraduate assistants (MIT)	2015
Clio Macrakis, High School intern (MIT)	2014

Peer-Reviewed Publications in National and International Journals

*indicates student/post-doc author under Hayes' supervision

24. Participants of COME ABOARD and DISCO XXV: A. J. Fassbender and 72 others including, **C. T. Hayes** (2017), [Perspectives on Chemical Oceanography in the 21st Century: Participants of the COME ABOARD Meeting examine aspects of the field in the context of 40 years of DISCO](#), *Marine Chemistry* 196, 191–190.
23. Wilson, S. T., F. O. Aylward, F. Ribalet, B. Barone, J. R. Casey, P. E. Connell, J. A. Eppley, S. Ferrón, J. N. Fitzsimmons, **C. T. Hayes**, A. E. Romano, K. A. Turk-Kubo, A. Vislova, E. V. Armbrust, D. A. Caron, M. J. Church, J. P. Zehr, D. M. Karl, and E. F. DeLong (2017), [Coordinated regulation of growth, activity and transcription in natural populations of the unicellular nitrogen-fixing cyanobacterium *Crocospaera*](#), *Nature Microbiology* 2, 17118.
22. **Hayes, C. T.**, J. Rosen*, D. McGee, and E. A. Boyle (2017), [Thorium distributions in high and low dust regions and the significance for iron supply](#), *Global Biogeochemical Cycles* 31, 328–347. → Featured on geotraces.org
21. **Hayes, C. T.**, D. McGee, S. Mukhopadhyay, E.A. Boyle, and A. C. Maloof (2017), [Helium and thorium isotope constraints on African dust transport to the Bahamas over recent millennia](#), *Earth and Planetary Science Letters* 457, 385–395.
20. Lerner, P., P. J. Lam, O. Marchal, R. F. Anderson, K. Buesseler, M. A. Charette, R. L. Edwards, **C. T. Hayes**, K.-F. Huang, Y. Lu, L. Robinson, and A. Solow (2016), [Corrigendum to “Testing models of thorium and particle cycling in the ocean using data from station GT11-22 of the U.S. GEOTRACES North Atlantic Section” \[Deep-Sea Res. I 113 \(2016\) 57–79\]](#), *Deep-Sea Research I* 118, 101.
19. Baker, A. R., W. M. Landing, E. Bucciarelli, M. Cheize, S. Fietz, **C. T. Hayes**, D. Kadko, P. L. Morton, N. Rogan, G. Sarthou, R. U. Shelley, Z. Shi, A. Shiller, and M. M. P. van Hulst (alphabetical order, after first 2 authors) (2016), [Trace element and isotope exchange at the air – sea interface: progress and research needs](#), *Philosophical Transactions of the Royal Society A* 374, 20160190.
18. Anderson, R. F., H. Cheng, R. L. Edwards, M. Q. Fleisher, **C. T. Hayes**, K.-F. Huang, D. Kadko, P. J. Lam, W. M. Landing, Y. Lao, Y. Lu, C. I. Measures, P. L. Morton, S. B. Moran, D. C. Ohnemus, L. F. Robinson, and R. U. Shelley (alphabetical order) (2016), [How well can we quantify dust deposition to the ocean?](#), *Philosophical Transactions of the Royal Society A* 374, 20150285.
17. Lerner, P., P. J. Lam, O. Marchal, R. F. Anderson, K. Buesseler, M. A. Charette, R. L. Edwards, **C. T. Hayes**, K.-F. Huang, Y. Lu, L. Robinson, and A. Solow (2016), [Testing](#)

- [models of thorium and particle cycling in the Ocean using data from station GT11-22 of the U.S. GEOTRACES North Atlantic Section](#), *Deep-Sea Research I* 113, 57–79.
16. Fitzsimmons, J. N., **C. T. Hayes**, S. al-Subiaï, P. L. Morton, R. Weisend, F. Ascani, and E. A. Boyle (2015), [Daily to decadal variability of size-fractionated iron and iron-binding ligands at the Hawaii Ocean Time-series Station ALOHA](#), *Geochimica et Cosmochimica Acta* 171, 303–324.
 15. **Hayes, C. T.**, J. N. Fitzsimmons, E. A. Boyle, D. McGee, R. F. Anderson, R. Weisend, and P. L. Morton (2015), [Thorium isotopes tracing the iron cycle at the Hawaii Ocean Time-Series Station ALOHA](#), *Geochimica et Cosmochimica Acta* 169, 1–16. → Featured on [MIT News](#)
 14. The GEOTRACES Group: E. Mawji, R. Schlitzer, E. Masferrer Dodas, and 133 others, including **C.T. Hayes** (2015), [The GEOTRACES Intermediate Data Product 2014](#), *Marine Chemistry* 177, 1–8.
 13. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. M. Vivancos, P. J. Lam, D. C. Ohnemus, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, and S. B. Moran (2015), [Intensity of Th and Pa scavenging partitioned by particle chemistry in the North Atlantic Ocean](#), *Marine Chemistry* 170, 49–60. → Featured on [geotraces.org](#)
 12. Anderson, R. F., and **C. T. Hayes** (2015), [Characterizing marine particles and their impact on biogeochemical cycles in the GEOTRACES program](#), *Progress in Oceanography* 133, 1–5.
 11. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, and S. B. Moran (2015), [²³⁰Th and ²³¹Pa on GEOTRACES GA03, the U.S. GEOTRACES North Atlantic Transect, and implications for modern and paleoceanographic chemical fluxes](#), *Deep-Sea Research II* 116, 29–41.
 10. **Hayes, C. T.**, A. Martinez-Garcia, A. Hasenfratz, S. L. Jaccard, D. A. Hodell, D. M. Sigman, G. H. Haug, and R. F. Anderson (2014) [A stagnation event in the deep South Atlantic during the last interglacial period](#), *Science* 346, 1514–1517.
 9. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, and R. Gersonde (2014), [Biogeography in ²³¹Pa/²³⁰Th ratios and a balanced ²³¹Pa budget for the Pacific Ocean](#), *Earth and Planetary Science Letters* 391, 307–318.
 8. Serno, S., G. Winckler, R. F. Anderson, **C. T. Hayes**, H. Ren, R. Gersonde, and G. H. Haug (2014), [Using the natural spatial pattern of marine productivity in the Subarctic North Pacific to evaluate paleo-productivity proxies](#), *Paleoceanography* 29, 438–453.
 7. Serno, S., G. Winckler, R. F. Anderson, **C. T. Hayes**, D. McGee, B. Machalett, H. Ren, S. M. Straub, R. Gersonde, and G. H. Haug (2014), [Eolian dust input to the Subarctic North Pacific](#), *Earth and Planetary Science Letters* 387, 252–263.
 6. **Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, S. Serno, G. Winckler, and R. Gersonde (2013), [Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes](#), *Earth and Planetary Science Letters* 383, 16–25. → Highlighted on [geotraces.org](#)

5. **Hayes, C. T.**, R. F. Anderson, S. L. Jaccard, R. François, M. Q. Fleisher, M. Soon, and R. Gersonde (2013), [A new perspective on boundary scavenging in the North Pacific Ocean](#), *Earth and Planetary Science Letters* 369–370, 86–97. → Highlighted on geotraces.org
4. Jaccard, S. L., **C. T. Hayes**, A. Martinez-Garcia, D. A. Hodell, R. F. Anderson, D. M. Sigman, and G. H. Haug (2013), [Two modes of change in Southern Ocean productivity over the past million years](#), *Science* 339, 1419–1423.
3. **Hayes, C. T.**, R. F. Anderson, and M. Q. Fleisher (2011), [Opal accumulation rates in the equatorial Pacific and mechanisms of deglaciation](#), *Paleoceanography* 26, PA1207.
→Featured in [Eos](#)
2. Ariya, P. A., J. Sun, N. A. Eltouny, E. D. Hudson, **C. T. Hayes**, and G. Kos (2009), [Physical and chemical characterization of bioaerosols - Implications for nucleation processes](#), *International Reviews in Physical Chemistry* 28, 1–32.
1. Mortazavi, R., **C. T. Hayes**, and P. A. Ariya (2008), [Ice nucleation activity of bacteria isolated from snow compared with organic and inorganic substrates](#), *Environmental Chemistry* 5, 373–381.

Manuscripts Submitted or In Preparation

- R. Schlitzer and >250 others, including **C. T. Hayes** (2018), The GEOTRACES Intermediate Data Product 2017 (submitted to *Chemical Geology*).
- Hayes, C. T.**, L.-S. Wen, C.-P. Lee, P. H. Santschi, K. Johannesson (2018), Metals in the Gulf of Mexico: synthesis and future directions (submitted for *Chemical Oceanography of the Gulf of Mexico*, Texas A&M University Press, ed. T. S. Bianchi).
- Hayes, C. T.**, R. F. Anderson, H. Cheng, T. M. Conway, R. L. Edwards, M. Q. Fleisher, P. Ho, K.-F. Huang, S. G. John, W. M. Landing, S. H. Little, Y. Lu, P. L. Morton, S. B. Moran, L. F. Robinson, R. U. Shelley, A. M. Shiller, X. Zheng (2018), Oceanic residence times of a spectrum of elements based on thorium supply (submitted to *Global Biogeochemical Cycles*).
- Hayes, C. T.**, E. E. Black, R. F. Anderson, M. Baskaran, K. O. Buesseler, M. A. Charette, J. K. Cochran, P. Fitzgerald, S. O. Morris, F. J. Pavia (alphabetical after first 2 authors) (2018) Flux of particulate elements in the North Atlantic Ocean constrained by multiple radionuclide systems (in preparation).

Funded Research (totaling \$726,418 raised personally)

- 2017–2020 National Science Foundation: Marine Geology and Geophysics Program. Sole PI: *Uranium isotopes and past changes in Southern Ocean circulation*. (\$239,539 to USM).
- 2017–2020 National Science Foundation: Chemical Oceanography Program. Co-PI with R. F. Anderson (Columbia) and R. L. Edwards and H. Cheng (Univ. Minnesota): *Collaborative Research: Using natural radionuclides to quantify the supply and removal of trace elements in the Pacific Ocean* (\$1,338,805 total; \$249,803 to USM).

- 2017–2019 National Academies Keck Future Initiatives: Discovering the Deep Blue Sea and the Gulf Research Program. Lead PI with Co-PI's R. Green (BOEM), M. Sieracki (NSF), L. Gershwin (CSIRO), and A. Kollias (ArtCenter): *Dive In: An Immersive and Wonder-Filled Virtual Reality Experience of Life in the Ocean's Mesopelagic Zone* (\$100,000 to USM).
- 2017–2019 National Academies Keck Future Initiatives: Discovering the Deep Blue Sea and the Gulf Research Program. Co-PI with B. Ballengée (LSU), D. Figueroa (UT-Rio Grande Valley), D. Murphy (USF), and A. Skarke (MSU): *Creating Resilience: Building a Gulf of Mexico NAKFI Alumni Working Group* (\$25,000 to Ballengée Studio LLC)
- 2015–2015 Antarctic Science Bursary of Antarctic Science Ltd. PI, in collaboration with J. Fitzsimmons (Texas A&M) and R. Sherrell (Rutgers): *Tracing continental inputs and organic matter export using the long-lived thorium isotopes on the Western Antarctic Peninsula* (£2380 to MIT)
- 2013–2015 W. O. Crosby Postdoctoral Fellowship: MIT competitive award. Independent projects on trace metal biogeochemistry at the Hawaii Ocean Time-series station, the Northwestern Atlantic and the Southern Ocean (\$134,000)

Invited Talks at Universities and Symposia

- University of Southern Mississippi: Department of Coastal Sciences Seminar (Oct. 2017)
- Texas A&M University: Oceanography Seminar (Nov. 2016)
- Tulane University: Earth and Environmental Science Seminar (Oct. 2016)
- MIT: Program in Atmospheres, Oceans and Climate Seminar (April 2015)
- University of Southern Mississippi: Department of Marine Science Seminar (April 2015)
- Caltech: Environmental Science and Engineering Seminar (Feb. 2015)
- University of Michigan: Smith Lecture (Nov. 2014)
- MIT: Chemical Oceanography and Geobiology Seminar (Nov. 2014)
- Stony Brook University: SOMAS Seminar (Aug. 2013)
- MIT: Chemical Oceanography and Geobiology Seminar (March 2013)
- Woods Hole Oceanographic Institution: "Climate and Paleo" Seminar (March 2013)
- Dissertations Symposium in Chemical Oceanography XXIII* (Hawaii, Oct. 2012)
- Princeton University: mini-conference on Fe fertilization (May 2012)

Service & professional activities

USM-Department-level Service

Seminar in Marine Science committee co-chair (2017–present)
Website coordinator (2017–present)
Outreach committee member (2016–present)
Facilities committee member (2016–present)
Policies & Procedure committee member (2017–present)
School of Ocean Science and Technology Governance committee member (2016–present)

USM-College-level Service

College of Science and Technology Faculty Council member (2016–present)

USM-University-level Service

University-National Oceanographic Laboratory Systems (UNOLS) institutional representative (2017–present)
American Association of University Professors (AAUP) local chapter committee member (2017–present)
Eagle SPUR, USM undergraduate Research Awards reviewer (Spring 2017)

National and International Academic Community Service

Institutional Representative to UNOLS (University-National Oceanography Laboratory Systems), 2017–present
National and International Conference Session Convener:
Marine micro-nutrients from the GEOTRACES program, AGU Fall Meeting, 2012
Carbon Storage in the Ocean now and over Time, Goldschmidt Meeting, 2018
Outstanding Student Paper Awards Coordinator, Ocean Sciences Section, AGU Fall Meeting 2016
Volunteer, National Ocean Sciences Bowl: Hurricane Bowl, Ocean Springs, MS, 2016–2018
Volunteer, Peter Anderson Festival Outreach, Ocean Springs, MS, 2016
Officer, Professional Development Organizing Committee for the Center for Microbial Oceanography: Research and Education (C-MORE), 2014–2015
Organizer, Lamont-Doherty Earth Observatory's weekly departmental seminar for Geochemistry, 2012–2013

Peer Reviewer for Submissions to the Following National and International Journals

<i>Nature Geoscience</i>	<i>Deep-Sea Research I</i>
<i>Nature Communications</i>	<i>Geochimica et Cosmochimica Acta</i>
<i>Proceedings of the National Academy of Sciences</i>	<i>Geochemistry, Geophysics, Geosystems</i>
<i>PLOS ONE</i>	<i>Paleoceanography</i>
<i>Philosophical Transactions of the Royal Society A</i>	<i>Analytica Chimica Acta</i>
<i>Geophysical Research Letters</i>	<i>Marine Geology</i>
<i>Earth and Planetary Science Letters</i>	<i>Marine Chemistry</i>
<i>Limnology & Oceanography</i>	<i>Estuarine, Coastal and Shelf Science</i>
<i>Journal of Geophysical Research-Oceans</i>	<i>Quaternary Science Reviews</i>
	<i>Journal of Industrial and Engineering Chemistry</i>

Peer Reviewer for the Following National and International Funding Agencies

Mail reviewer for proposals to:

U.S. National Science Foundation: Chemical Oceanography program
U.S. National Science Foundation: Marine Geology and Geophysics program
U.K. Natural Environment Research Council

Panel reviewer for proposals to:

U.S. National Science Foundation: Chemical Oceanography program (2015)

Professional Society Memberships

American Chemical Society: 2007–2009
American Geophysical Union: 2009–present
Geochemical Society: 2010–present
Association for the Sciences of Limnology and Oceanography: 2016–present
American Association of University Professors: 2017–present
American Association for the Advancement of Science: 2018–present

Ocean and Field Research Expeditions (~149 days at sea)

November 2017	USM Graduate Student Field Trip and Sampling Expedition <i>R/V Point Sur</i> : Gulfport, MS to Deepwater Horizon well site, 2 days at sea. Water sampling and student training.
October 2016	USM Graduate Student Field Trip and Sampling Expedition <i>R/V Point Sur</i> : Gulfport, MS to Deepwater Horizon well site, 2 days at sea. Water sampling and student training.
April, November 2016,	Mississippi Sound and Barrier Island Sampling

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- March 2017 Assisted Drs. Hannah Box and Dongjoo Joung (USM) in sampling of seawater and groundwater. 5 Day trips to Ship, Horn and Dauphin Island
- July–August 2015 SCOPE/C-MORE Summer Cruise
Simons Collaboration of Ocean Processes and Ecology
R/V *Kilo Moana* (KMI513): Honolulu, HI to Honolulu, HI
12 days at sea; Water sampling and filtration/ultrafiltration
- May–June 2014 UNOLS Chief Scientist Training Cruise
R/V *Atlantic Explorer* (AE1410): Bridgetown, Barbados to St. Georges, Bermuda, 9 days at sea; Aerosol and water sampling
- March 2014 Northwest Andros Island, Bahamas (Three Creeks area)
Water and sediment coring in tidal flats; 3 days in field
- September 2013 Hawaii Ocean Experiment – Phosphorus Rally II (HOE-PhoR II)
R/V *Kilo Moana* (KMI316): Honolulu, HI to Honolulu, HI, 12 days at sea; Water sampling and filtration/ultrafiltration
- November–December 2011 U. S. GEOTRACES: North Atlantic Zonal Transect, Leg 2
R/V *Knorr* (KN204-1A+B): Woods Hole, MA to St. Georges, Bermuda to Praia, Cape Verde, 35 days at sea
Water Sampling Manager
- October 2010 U. S. GEOTRACES: North Atlantic Zonal Transect, Leg 1
R/V *Knorr* (KN199-4): Lisbon, Portugal to Mindelo, Cape Verde, 20 days at sea; Water Sampling Manager
- July–August 2009 The Innovative North Pacific Experiment (INOPEX)
R/V *Sonne* (SO-202): Tomakomai, Japan to Busan, South Korea, 50 days at sea; Water, sediment, and plankton sampling

Prior Research Experience

- 2007–2008 Research Assistant for Dr. Parisa Ariya (Chemistry and Atmospheric and Oceanic Sciences, McGill University) – Bio-aerosols and ice nucleation – Air and snow sampling
- Summer 2006 Research Assistant for Dr. Claire Rutledge (Entomology, Connecticut Agricultural Experiment Station) – Chemical ecology of wood-boring insects – State-wide tree survey, bio-assays, trap maintenance

Non-exhaustive List of Conference Presentations and Abstracts

Hayes, C. T., E. E. Black, F. J. Pavia, R. F. Anderson, M. Baskaran, K. O. Buesseler, M. A. Charette, P. Fitzgerald, J. K. Cochran (2018) Sinking flux profiles of carbon and trace

elements in the North Atlantic Ocean constrained by multiple radionuclide systems, *AGU Ocean Sciences Meeting* (Portland, OR, February). Oral Presentation.

Hayes, C. T., D. J. Wallace (2017), Exploring records of Saharan dust transport and hurricanes in the Caribbean and Gulf of Mexico over recent millennia, *AGU Fall Meeting* (New Orleans, LA, December). Invited Oral Presentation.

Hayes, C. T., (2017), Extrapolating from thorium to other parts of the periodic table in the ocean, *Gordon Research Conference: Chemical Oceanography* (New London, NH, July). Invited Oral Presentation.

Kuzminov, A., **C. T. Hayes,** R. Anderson, L. Godfrey, S. Severmann (2017), Uranium paradox: isotope ratios from the Southern Ocean, *Gordon Research Conference: Chemical Oceanography* (New London, NH, July).

Hayes, C. T. (2017), Contrasting protactinium regimes between the North Pacific and the North Atlantic, *PAGES Open Science Meeting* (Zaragoza, Spain, May). Invited Oral Presentation.

Hayes, C. T., J. N. Fitzsimmons, P. L. Morton, D. McGee, E. A. Boyle (2017), Diel trace metal variations in the North Pacific subtropical gyre, *ASLO Aquatic Sciences Meeting* (Honolulu, HI, February). Oral Presentation.

Hayes, C. T., S. Severmann, A. Anderson (2016), Uranium-234 anomalies in authigenic uranium as a new oxygenation proxy in the Southern Ocean, *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.

Lu, Y., R. L. Edwards, H. Cheng, R.F. Anderson, **C. T. Hayes,** M. Q. Fleisher, P. J. Lam, K. F. Huang, L. F. Robinson, X. Wang (2016), ^{230}Th and ^{231}Pa in seawater sinking particles from the North Atlantic GEOTRACES Transect. *AGU Fall Meeting* (San Francisco, CA, December).

Hayes, C. T., D. McGee, E. A. Boyle, S. Mukhopadhyay, A. C. Maloof (2016), Isotopic accounts of mineral dust deposition in the northwestern subtropical Atlantic from seasons to recent millennia, *AGU Ocean Sciences Meeting* (New Orleans, LA, February). Oral Presentation.

Hayes, C. T., D. McGee, E. A. Boyle (2015), Thorium isotope observations for the dust proxy from Barbados to Bermuda and at Station ALOHA, *Royal Society Meeting on Ocean Trace Element Chemistry* (London, December). Poster Presentation.

Wu, Y., S. L. Goldstein, L. Pena, **C. T. Hayes,** R. F. Anderson, R. Gersonde (2015) Constraining the sources of neodymium in the North Pacific Ocean, *AGU Fall Meeting* (San Francisco, CA, December).

Hayes, C. T., A. Martinez-Garcia, A. P. Hasenfratz, S. L. Jaccard, D. A. Hodell, D. M. Sigman, G. H. Haug, R. F. Anderson (2014), A millennial-scale reduction in ventilation of the deep South Atlantic during the last interglacial period, *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.

Weisend, R., P. L. Morton, W. M. Landing, J. N. Fitzsimmons, **C. T. Hayes,** E. A. Boyle (2014), Particulate trace element cycling in a diatom bloom at Station ALOHA. *AGU Fall Meeting* (San Francisco, CA, December).

- Morton, P. L., R. Weisend, W. M. Landing, J. N. Fitzsimmons, **C. T. Hayes**, E. A. Boyle (2014), Trace element cycling in lithogenic particles at Station ALOHA. *AGU Fall Meeting* (San Francisco, CA, December).
- Hayes, C. T.**, M. Q. Fleisher, R. F. Anderson, P. J. Lam, D. Ohnemus, K.-F. Huang, L. F. Robinson, Y. Lu, H. Cheng, R. L. Edwards, S. B. Moran (2014), Proxy Applications of Pa/Th Investigated with Scavenging Chemistry in the North Atlantic. *AGU Fall Meeting* (San Francisco, CA, December). Poster Presentation.
- Hayes, C. T.**, E. A. Boyle, D. McGee, J. N. Fitzsimmons, R. F. Anderson (2014), $^{232}\text{Th}/^{230}\text{Th}$ at the Hawaii Ocean Time-Series Station ALOHA: A tool for iron cycling. *AGU Ocean Sciences Meeting* (Honolulu, HI, February). Poster Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, K. F. Huang, D. C. Ohnemus, P. J. Lam, R. L. Edwards, H. Cheng, S. B. Moran (2013), Scavenging intensity and elemental fractionation in the North Atlantic. *Gordon Research Conference: Chemical Oceanography* (Biddeford, ME, August). Poster Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, R. Gersonde (2013), Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes. *93rd Annual AMS Meeting: Robert A. Duce Symposium* (Austin, TX, January). Oral Presentation.
- Anderson, R. F., **C. T. Hayes** (2013), New insights into geochemical proxies from GEOTRACES. *International Conference on Paleoceanography (ICP-11)*. (Barcelona, Spain, September).
- Anderson, R. F., **C. T. Hayes**, M. Q. Fleisher, L. F. Robinson, K.-F. Huang, H. Cheng, L. Sha, R. L. Edwards, Y. Lu, S. B. Moran (2013), Constraining rates of trace element supply and removal using long-lived thorium isotopes. *Mineralogical Magazine*, 77(5) 594 (Goldschmidt Conference, Florence, Italy, August).
- Hayes, C. T.**, R. F. Anderson (2012), Rapid uranium enrichment in the South Atlantic during Marine Isotope Stage 5e. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, K. F. Huang, D. C. Ohnemus, P. J. Lam, R. L. Edwards, H. Cheng, S. B. Moran (2012), Scavenging and fractionation of $^{231}\text{Pa}/^{230}\text{Th}$ in the U. S. North Atlantic GEOTRACES transect. *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.
- Winckler, G., S. Serno, **C. T. Hayes**, R. F. Anderson, R. Gersonde, G. H. Haug (2012), Quantifying dust input to the Subarctic North Pacific-Results from surface sediments and sea water thorium isotopes. *AGU Fall Meeting* (San Francisco, CA, December).
- Serno, S., G. Winckler, R. F. Anderson, H. A. Ren, **C. T. Hayes**, B. Machalett, R. Gersonde, G. H. Haug (2012), Dust fertilization of biological productivity in the Subarctic North Pacific during the last 150 kyr. *AGU Fall Meeting* (San Francisco, CA, December).
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, R. Gersonde (2012), The nature of boundary scavenging in the North Pacific Ocean. *Mineralogical Magazine*, 75, 1825. (Goldschmidt Conference, Montreal, Canada, June). Oral Presentation.

- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher, L. F. Robinson, H. Cheng, R. L. Edwards, and S. B. Moran (2012), Pa and Th distributions along the GEOTRACES North Atlantic Transect. *AGU Ocean Sciences Meeting* (Salt Lake City, UT, February). Oral Presentation.
- Anderson, R. F., **C. T. Hayes**, M. Q. Fleisher, L. F. Robinson, K. F. Huang, R. L. Edwards, H. Cheng, S. B. Moran, R. Gersonde, M. Hatta (2012), Aerosol supply of soluble trace elements to the ocean evaluated using paired thorium isotopes. *AGU Ocean Sciences Meeting* (Salt Lake City, UT, February).
- Robinson, L., K.-F. Huang, M. E. Auro, R. F. Anderson, **C. T. Hayes**, M. Q. Fleisher, H. Cheng, R. L. Edwards, S. B. Moran, M. Saito (2012), Sources, sinks and cycling of seawater ^{232}Th in the north and south Atlantic basins. *Mineralogical Magazine*, 75, 2291. (Goldschmidt Conference, Montreal, Canada, June).
- Anderson, R., **C. T. Hayes**†, M. Fleisher, L. Robinson, K.-F. Huang, R. L. Edwards, S. B. Moran (2012), Dissolved $^{231}\text{Pa}/^{230}\text{Th}$ in the U. S. GEOTRACES North Atlantic Zonal Transect. *Mineralogical Magazine*, 75, 1424. (Goldschmidt Conference, Montreal, Canada, June).
†Presenting author for oral presentation.
- Winckler, G., S. Serno, R. F. Anderson, **C. T. Hayes**, H. Ren, R. Gersonde, G. Haug (2012), Atmospheric dust input to the Subarctic North Pacific. *Mineralogical Magazine*, 75, 2550. (Goldschmidt Conference, Montreal, Canada, June).
- Hayes, C. T.**, S. L. Jaccard, A. Martinez-Garcia, E. D. Galbraith, D. A. Hodell, R. F. Anderson, D. M. Sigman, G. H. Haug (2011), Southern Ocean dynamics regulate atmospheric $p\text{CO}_2$ variability over the past million years. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Serno, S., G. Winckler, R. F. Anderson, R. Gersonde, **C. T. Hayes**, G. H. Haug (2011), Modern dust flux and biological productivity in the Subarctic North Pacific. *International Union for Quaternary Research Congress (INQUA-XVIII)* (Bern, Switzerland, August).
- Hayes, C. T.**, R. F. Anderson, R. Gersonde (2011), The influence of boundary scavenging and particle composition on dissolved and buried ^{230}Th and ^{231}Pa in the subarctic North Pacific. *Mineralogical Magazine*, 75, 994. (Goldschmidt Conference, Prague, Czech Republic, August). Oral Presentation.
- Serno, S., **C. T. Hayes**, G. Winckler, R. F. Anderson (2010), Deciphering past and modern linkages between dust influx, biological productivity and climate change in the Subarctic North Pacific. *Workshop DUSTSPEC: Dust records for a changing world*, (Palisades, NY, May).
- Hayes, C. T.**, R. F. Anderson (2010), Wind-driven upwelling in the Southern Ocean during glacial terminations. *Gary C. Comer Abrupt Climate Change Conference* (Leeward Farm, WI, September). Oral Presentation.
- Hayes, C. T.**, R. F. Anderson (2010), Wind-driven upwelling in the Southern Ocean across Termination II. *Tenth International Conference on Paleoceanography (ICP-X)* (La Jolla, CA, August). Poster Presentation.
- Hayes, C. T.**, R. F. Anderson, M. Q. Fleisher (2009), Deglacial opal accumulation in the equatorial Pacific and signatures of the Southern Ocean. *AGU Fall Meeting* (San Francisco, CA, December). Oral Presentation.

Professional Workshop Participation

Ocean Sciences Meeting Town Hall, Portland, OR: Developing a framework for trace element, isotope, and other biogeochemical research in the Gulf of Mexico and Caribbean Sea. Invited Speaker (February 2018).

Ocean Sciences Meeting Town Hall, Portland, OR: Release of new (IDP2017) GEOTRACES data product. Invited Speaker (February 2018).

NOAA Office of Exploration and Research workshop, Honolulu, HI: From Seafloor to Surface: Exploration of the Water Column (March 2017). Invited Speaker.

National Academies Keck Futures Initiates, Irvine, CA: NAKFI conference: Discovering the Deep Blue Sea: Research, Innovation, Social Engagement (November 2016).

University of Hawaii, Honolulu, HI: COME ABOARD: Chemical Oceanography Meeting: A Bottom-Up Approach to Research Directions (October 2016).

La Jolla, CA: GEOTRACES cruise planning meeting for Alaska-Tahiti section (Oct. 2016).

Lamont-Doherty Earth Observatory, Palisades, NY: GEOTRACES synthesis meeting on internal cycling of trace elements in the ocean. Working group co-chair (August 2016).

London and Chicheley, United Kingdom: Royal Society Meeting on synthesis of GEOTRACES data: sources and sinks of trace elements in the ocean (December 2015).

University of Bern, Switzerland: IPODS Workshop on Past Ocean Dynamics (Oct. 2014).

Ocean Sciences Meeting Town Hall, Honolulu, HI: GEOTRACES intermediate data product release. Invited Speaker (February 2014).

Dissertation & Theses

Doctoral Dissertation:

Columbia University, New York, NY, 2013, Earth and Environmental Sciences
[*Marine thorium and protactinium distributions: Tools for past and present chemical flux*](#)

The chapters of this dissertation were developed for publication as numbers [5](#), [6](#), [9](#), [11](#), and [13](#), as listed in the above publication section.

Master's Thesis:

Columbia University, New York, NY, 2010, Earth and Environmental Sciences
Opal accumulation rates in the equatorial Pacific and deglacial mechanisms

This thesis was developed for publication as number [3](#) in the above publication section.

Undergraduate Thesis:

McGill University, Montreal, QC, 2008, Honours Chemistry (Environmental)
Ice nucleation activity of organic aerosols

This thesis contributed to publication numbers [1](#) and [2](#) in the above publication section.