

## GEOFFREY GEBBIE

### Education

1997 B.S., University of California; Atmospheric Sciences, *Magna Cum Laude*, Los Angeles, CA

2004 Ph.D., Massachusetts Institute of Technology / Woods Hole Oceanographic Institution;  
Physical Oceanography, Cambridge/Woods Hole, MA

### Positions Held

2018 – present Associate Scientist with Tenure, Woods Hole Oceanographic Institution –  
Physical Oceanography Department, Woods Hole, MA

2014 – 2018 Associate Scientist without Tenure, Woods Hole Oceanographic Institution –  
Physical Oceanography Department, Woods Hole, MA

2010 – 2014 Assistant Scientist, Woods Hole Oceanographic Institution - Physical  
Oceanography Department, Woods Hole, MA

2007 – 2011 Visiting Scientist, Massachusetts Institute of Technology, Cambridge, MA

2007 – 2010 Research Scientist, Harvard University, Cambridge, MA

2004 – 2007 Postdoctoral Fellow, Harvard University, Cambridge, MA  
*Supervisor: Eli Tziperman*

1998 – 2004 Research Assistant, MIT/WHOI Joint Program, Cambridge/Woods Hole, MA  
*Advisors: Carl Wunsch, Patrick Heimbach*

### Research Interests

Connecting physical oceanography and climate dynamics. Estimating past ocean circulation and its role in paleoclimate, using physical models and biogeochemical records. Leveraging paleo-oceanographic and historical instrumental data to understand the 20<sup>th</sup> and 21<sup>st</sup> centuries. Analyzing climate variability through state estimation, especially the synthesis of general circulation models and observations.

### Honors and Awards

Moltz Fellow of the WHOI Ocean and Climate Change Institute, 2015 – 2019

Tenured Associate Scientist Award, WHOI, 2018

*Eos* Research Spotlight, 2016

*Paleoceanography*, Highlighted article, 2014

American Meteorological Society, Paper of Note, 2007

NASA Earth System Science Fellow, 2000 – 2003

Outstanding Student Paper, American Geophysical Union Fall Meeting, 2002

Outstanding Student Poster, World Ocean Circulation Experiment Meeting, 2002

## Professional Publications and Presentations

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Author or co-author of 45 refereed publications and 5 other publications. Author or co-author of approximately 86 conference abstracts; presenter at 46 national and international conferences, symposia and workshops.

## Refereed Publications

(\*-graduate student advisee, \*\*-postdoctoral supervisee, \*\*\*-Summer Student Fellow)

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- \*\*Chan D., G. Gebbie, P. Huybers, 2023: "Ensemble of land-surface air temperatures between 1880-2022 using a revised pair-wise homogenization algorithm," submitted to *J. Climate*. *Contribution: Postdoctoral supervisor and co-writing*.
- Rand D., G. Gebbie, L.E. Lisiecki, 2023: "Quantifying Benthic  $\delta^{18}\text{O}$  Lags Across Termination 1: A Probabilistic Approach Based on Radiocarbon and Benthic  $\delta^{18}\text{O}$  Chronologies," *Geophys. Geochem. Geosys.*, in press. *Contribution: Study design and co-writing*.
- \*\*Chan, D., G. Gebbie, and P. Huybers, 2023: "Revised global temperatures indicate 1.5°C warming by 2030," submitted to *Nature*.
- Jenkins, W.J., A. Seltzer, G. Gebbie, and C. German, 2023: "Deep Pacific evidence for a strengthening circumpolar trough over the last two millennia," submitted to *Nature Geoscience*. *Contribution: Software and analysis to invert noble gas data, co-wrote manuscript*.
- \*Davila, X., A. Olsen, S.K. Lauvset, E.L. McDonagh, A. Brakstad, and G. Gebbie, 2023: "Origins of oxygen minimum zones," *J. Geophys. Res. Oceans*, 128, e2023JC019677, doi:10.1029/2023JC019677. *Contribution: Provided inverse model for diagnostics, co-wrote manuscript*.
- Lu, W., D.W. Oppo, G. Gebbie, and D.J.R. Thornalley, 2023: "Surface climate signals transmitted rapidly to deep North Atlantic throughout last millennium," submitted to *Science*. *Contribution: Conceived, funded, and designed the study, provided circulation metrics for quantitative analysis, co-wrote the manuscript*.
- Lee, T., D. Rand, L.E. Lisiecki, G. Gebbie, and C. Lawrence, 2023: "Bayesian age models and stacks: Combining age inferences from radiocarbon and benthic  $\delta^{18}\text{O}$  stratigraphic alignment," *Climate of the Past*, in press. *Contribution: Conceived of the research and supervised Brown University graduate student to write the manuscript*.
- \*\*Cimoli, L., G. Gebbie, S. Purkey, and W.M. Smethie, 2023: "Annually-resolved propagation of CFCs and SF6 in the global ocean over eight decades," *J. Geophys. Res. Oceans*, 128, e2022JC019337, doi:10.1029/2022JC019337. *Contribution: Supervised Scripps postdoc lead author, developed Green's function analysis technique, co-wrote paper*.
- \*Brakstad, A., G. Gebbie, K. Vage, E. Jeansson, S.R. Olafsdottir, 2023: "Formation and pathways of dense water in the Nordic Seas based on a regional inversion," *Prog. Oceanogr.*, 212, doi:10.1016/j.pocean.2023.102981. *Contribution: Wrote inverse method, advised graduate student, advised graduate student for modifications of numerical analysis, co-wrote paper*.

- \*\*Chan, D., G. Gebbie, and P. Huybers, 2023: “Global and regional discrepancies between early-twentieth-century coastal air and sea surface temperature detected by a coupled energy-balance analysis,” *J. Climate*, 36, 2205-2220, doi:10.1175/JCLI-D-22-0569.1. *Contribution: Supervised WHOI Postdoctoral Fellow, co-wrote manuscript.*
- Kilbourne, K.H., A.D. Wanamaker, P. Moffa-Sanchez, D.J. Reynolds, D.E. Amrhein, P.G. Butler, G. Gebbie, M. Goes, M.F. Jansen, C.M. Little, and M. Mette, 2022: “Atlantic circulation change still uncertain,” *Nature Geoscience*, 15, pp.165-167. *Contribution: Co-wrote paper as part of US CLIVAR AMOC Science Team.*
- Wenegrat, J.O., E. Bonanno, U. Rack, and G. Gebbie. "A century of observed temperature change in the Indian Ocean," 2022: *Geophys. Res. Lett.*, 49, e2022GL098217. *Contribution: Performed data analysis, developed analysis method, revised the manuscript.*
- \*Davila, X., G. Gebbie, \*A. Brakstad, S.K. Lauvset, E.L. McDonagh, J. Schwinger, and A. Olsen, 2022: “How is the ocean anthropogenic carbon reservoir filled?”, *Global Biogeochemical Cycles*, 36, e2021GB007055. *Contribution: co-advised graduate student first author.*
- Gebbie, G., 2021: Combining Modern and Paleooceanographic Perspectives of Ocean Heat Uptake, *Annu. Rev. Mar. Sci.*, 13, 16.1–16.27, doi:10.1146/annurev-marine-010419-010844.
- Piecuch, C.G., A.C. Kemp, G. Gebbie, and A.J. Meltzner, 2021: “Climate did not drive Common Era Maldivian sea-level lowstands." *Nature Geoscience* 14, 273-275, doi:10.1038/s41561-021-00731-2. *Contribution: Performed ocean model simulations and co-wrote the manuscript.*
- \*Moree, A.L., T. Sun, A. Bretones, E.O. Straume, K. Nisancioglu, and G. Gebbie, 2021: "Cancellation of the precessional cycle in d18O records during the early Pleistocene," *Geophys. Res. Lett.*, 48, doi:10.1029/2020GL090035. *Contribution: Conceived of the research and supervised summer school (ACDC) students to write the manuscript.*
- Gebbie, G., 2020: “Cancellation of deglacial thermosteric sea-level rise by a barosteric effect,” *J. Phys. Oceanogr.*, 50, 3623-3639, doi:10.1175/JPO-D-20-0173.1
- Gebbie, G., and P. Huybers, 2019: “The Little Ice Age and 20<sup>th</sup> Century deep Pacific cooling,” *Science*, 363, 70-74, doi:10.1126/science.aar8413.
- Simms, A.R., and L.E. Lisiecki, G. Gebbie, P.L. Whitehouse, and J.F. Clark, 2019: “Balancing the Last Glacial Maximum (LGM) sea-level budget,” *Quaternary Science Reviews*, 205, 143-153, doi:10.1016/j.quascirev.2018.12.018. *Contribution: Provided physical oceanography expertise, numerical calculations of steric height, co-wrote paper.*
- Gebbie, G., 2019: “Atlantic warming since the Little Ice Age,” *Oceanography*, 32, 220–230, doi:10.5670/oceanog.2019.151.
- Gebbie, G., A. R. Simms, and L. E. Lisiecki, 2019: “Why deglacial ice loss estimates are biased low,” *Earth Planet. Sci. Lett.*, 515, 112-124., doi:10.1016/j.epsl.2019.03.017.

- Lacerra, M., D.C. Lund, G. Gebbie, D.W. Oppo, J. Yu, A. Schmittner, and N.E. Umling, 2019: "Less remineralized carbon in the intermediate depth South Atlantic during Heinrich Stadial 1," *Paleoceanography and Paleoclimatology*, 34, 1218-1233, doi:10.1029/2018PA003537. *Contribution: Provided ocean product for glacial water masses, provided physical oceanography expertise and background.*
- Umling, N., D.W. Oppo, P. Chen, J. Yu, Z. Liu, M. Yan, G. Gebbie, D.C. Lund, K.R. Pietro, Z.D. Jin, K.-F. Huang, K.B. Costa, and F.A.L. Toledo, 2019: "Atlantic Circulation and ice sheet influences on upper South Atlantic temperatures during the last deglaciation," *Paleoceanography and Paleoclimatology*, 34, 990-1005, doi:10.1029/2019PA003558. *Contribution: Provided ocean product for glacial water masses.*
- Purkey, S.G., W.M. Smethie, G. Gebbie, A.L. Gordon, R.E. Sonnerup, M. J. Warner, and J.L. Bullister, 2018: "A Synoptic View of the Ventilation and Circulation of Antarctic Bottom Water from Chlorofluorocarbons," *Ann. Rev. Mar. Sci.*, 10, doi:10.1146/annurev-marine-121916-063414. *Contribution: Analyzed decades of CFC-11 data and produced a time-evolving objective map of their spread; wrote multiple sections of the paper; provided revisions on the entire manuscript.*
- Zhao, N., O. Marchal, L.D. Keigwin, D.E. Amrhein, and G. Gebbie, 2018: "A synthesis of deglacial deep-sea radiocarbon records and a test of their (in)consistency with modern ocean ventilation," *Paleoceanography and Paleoclimatology*, 33, <https://doi.org/10.1002/2017PA003174>. *Contribution: Served as thesis committee member to the lead author; provided empirical ocean circulation for comparison to radiocarbon data; revised and commented on manuscript.*
- Oppo, D.W., G. Gebbie, K-F. Huang, W.B. Curry, T.M. Marchitto, and K.R. Pietro, 2018: "Data constraints on Glacial Atlantic Water Mass Geometry and Properties," *Paleoceanography and Paleoclimatology*, 33, 1013-1034, doi:10.1029/2018PA003408. *Contribution: Inverted paleoceanographic data for glacial water mass geometry, wrote paper.*
- Gebbie, G., and \*\*\*T.-L. Hsieh, 2017: "Controllability, not chaos, key criterion for ocean state estimation," *Nonlin. Proc. Geophys.*, 24, 351–366, doi:10.5194/npg-24-351-2017.
- \*Streletz, G.J., G. Gebbie, B. Hamann, and O. Kreylos, 2016: "Interpolating Sparse Scattered Data Using Flow Information," *J. Computational Sci.*, 16, 156–169, doi:10.1016/j.jocs.2016.04.001. *Contribution: Served as co-advisor to the graduate student with B. Hamann; directed the oceanographic component of the research including the usage of observational datasets and adaptation of oceanographic statistical techniques for computer science; co-wrote and revised manuscript.*
- Gebbie, G., \*G.J. Streletz, and H.J. Spero, 2016: "How well would modern-day property distributions be known with paleoceanographic-like observational sampling?" *Paleoceanography*, 31, doi:10.1002/2015PA002917. *Highlighted in Eos.*
- Thornalley, D.J.R., H. Bauch, G. Gebbie, W. Guo, M. Ziegler, S. Bernasconi, S. Barker, L. Skinner and J. Yu, 2015: "A poorly ventilated deep Arctic Mediterranean during the last glacial," *Science*, 349, 706–710. *Contribution: Wrote and implemented two numerical models of the Arctic Ocean, a 1D column model and a 3D model with connections to the*

*global ocean; confirmed that the findings of the lead author are physically plausible given assumptions about Arctic throughflow; provided 1 figure and text; offered comments and revisions on the manuscript.*

Gebbie, G., C.D. Peterson, L.E. Lisiecki, and H.J. Spero, 2015: "Global-mean  $\delta^{13}\text{C}$  and its uncertainty in a glacial state estimate," *Quaternary Sci. Rev.*, **125**, doi://10.1016/j.quascirev.2015.08.010.

Kronenberger, M., C. Weber, G. Gebbie, O. Kreylos, L.H. Kellogg, L.E. Lisiecki, C.D. Peterson, H.J. Spero, B. Hamann, and H. Hagen, 2015: "A novel distance measure for ocean reconstruction from sparse observations demonstrated on the Atlantic," in: Talbot, J., Keahey, A. and Wright, W., eds., *Proceedings of IEEE Scientific Visualization 2015 (SciVis 2015) - Visualization in Practice*, IEEE Computer Society Press, Los Alamitos, California. *Contribution: Provided physical oceanographic expertise to link the computer scientist lead author to paleoceanographic data; provided modern-day hydrographic datasets to the lead author; read and revised the manuscript.*

\*Amrhein, D.E., G. Gebbie, O. Marchal, and C. Wunsch, 2015: "Inferring surface water equilibrium calcite  $\delta^{18}\text{O}$  during the last deglacial period from benthic foraminiferal  $\delta^{18}\text{O}$  records: Implications for ocean circulation," *Paleoceanography*, 30, 1470–1489, doi:10.1002/2014PA002743. *Contribution: Served as co-advisor to M.S. student; provided the mathematical basis of the work, all of the numerical codes, and a modern-day circulation estimate; co-wrote the paper.*

Gebbie, G., 2014: "How much did Glacial North Atlantic Water shoal?" *Paleoceanography*, 29, doi:10.1002/2013PA002557. *Editor's research highlight.*

Lopez, H., B.P. Kirtman, E. Tziperman, and G. Gebbie, 2013: "Impact of Interactive Westerly Wind Bursts on CCSM3," *Dynamics of Atmospheres and Oceans*, 59, 24–51, doi: 10.1016/j.dynatmoce.2012.11.001. *Contribution: Ported my westerly wind burst code from the Modular Ocean Model to the Community Climate System Model; performed a tutorial in Miami, FL, to author #1 and #2 for use of the model; provided feedback on all drafts of the manuscript.*

Gebbie, G., and P. Huybers, 2012: "The mean age of ocean waters inferred from radiocarbon observations: upper and lower bounds, sensitivity to surface sources, and accounting for mixing histories," *Journal of Physical Oceanography*, 42, 291–305, doi:10.1175/JPO-D-11-043.1.

Gebbie, G., 2012: "Tracer transport timescales and the observed Atlantic-Pacific lag in the timing of the Last Termination," *Paleoceanography*, 27, doi:10.1029/2011PA002273.

Gebbie, G., and P. Huybers, 2011: "How is the ocean filled?" *Geophys. Res. Lett.*, 38, L06604, doi:10.1029/2011GL046769.

Gebbie, G., and P. Huybers, 2010: "Total matrix intercomparison: A method for determining the geometry of water-mass pathways," *J. Phys. Oceanogr.*, 49, 1710–1728, doi:10.1175/2010JPO4272.1.

Gebbie, G., and E. Tziperman, 2009: "Predictability of SST-modulated westerly wind bursts," *J. Climate*, 22, 3894–3909, doi:10.1175/2009JCLI2516.1.

- Gebbie, G., and E. Tziperman, 2009: “Incorporating a semi-stochastic model of ocean-modulated westerly wind bursts into an ENSO prediction model,” *Theor. Appl. Climatol.*, 97, doi:10.1007/s00704-008-0069-6.
- Gebbie, G., I. Eisenman, A. Wittenberg, and E. Tziperman, 2007: “Modulation of westerly wind bursts by sea surface temperature: A semi-stochastic feedback for ENSO,” *J. Atmos. Sci.*, 64, 3281–3295, doi:10.1175/JAS4029.1.
- Gebbie, G., 2007: “Does eddy subduction matter in the northeast Atlantic Ocean?” *J. Geophys. Res. Oceans*, 112, C06007, doi:10.1029/2006JC003568.
- Huybers, P., G. Gebbie, and O. Marchal, 2007: “Can paleoceanographic tracers constrain meridional circulation rates?” *J. Phys. Oceanogr.*, 37, 394–407, doi:10.1175/JPO3018.1. *Contribution: wrote the basis of the numerical code for the inverse model; provided guidance on modifications to the base code; co-wrote the paper including being the primary writer for the Methods section.*
- Gebbie, G., and P. Huybers, 2006: “Meridional circulation during the Last Glacial Maximum explored through a combination of  $\delta^{18}\text{O}$  observations and a geostrophic inverse model,” *Geochem., Geophys., Geosys.*, 7, Q11N07, doi:10.1029/2006GC001383.
- Gebbie, G., P. Heimbach, and C. Wunsch, 2006: “Strategies for nested and eddy-permitting state estimation,” *J. Geophys. Res. Oceans*, 111, C10073, doi:10.1029/2005JC003094.

#### Other Publications

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- Gebbie, G., 2004: “Subduction in an eddy-resolving state estimate of the northeast Atlantic Ocean,” Ph.D. dissertation, MIT-WHOI Joint Program in Oceanography, 196pp.
- Gebbie, G., and I. Eisenman, A. Wittenberg, and E. Tziperman, 2007: “Could ocean modulated wind bursts lead to improved forecasts of El Niño?” *Bulletin of the American Meteorology Society*, **88**, 1356–1357.
- Bronimann, S., J. Franke, P. Breitenmoser, G. Hakim, H. Goosse, M. Widmann, M. Crucifix, G. Gebbie, A. Paul, J. Annan, and G. van der Schrier, 2013: “Transient state estimation in paleoclimatology using data assimilation,” *PAGES (Past Global Changes) news*, **21** (2), 74–75.
- Edwards, T., J. Annan, M. Crucifix, G. Gebbie, H. Goosse, and A. Paul, 2013: “Best-of-both-worlds estimates of timeslices of the past,” *PAGES (Past Global Changes) news*, **21** (2), 76–77.
- Gebbie, G., 2022: “Historical Indian Ocean Temperature Change (v1.0.1),” Zenodo, doi:10.5281/zenodo.6689976.

#### Education Activities

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J. Seward Johnson Chair, Education Coordinator, Physical Oceanography, 2021 – present



Instructor, MIT/WHOI Joint Program class 12.805, “Data Analysis in Physical Oceanography,” 2016, 2017, 2019, 2020, 2022, 2023  
 Instructor, MIT/WHOI Joint Program class 12.808, “Introduction to Observational Physical Oceanography,” 2013, 2014, 2015, 2023  
 Organizing Committee and Lecturer, Advanced Climate Dynamics Course (ACDC), 2009 – present: Bergen, Norway, 2009; Lyngen, Norway, 2010; Friday Harbor, WA, 2011; Snoheim, Norway, 2012; Lofoten, Norway, 2013; Disko Island, Greenland, 2014; Heradskolinn, Iceland, 2015; Bonne Bay, Newfoundland, 2016; Rondane National Park, Norway, 2017; Hardangervidda, Norway, 2018; Yosemite National Park, CA, 2019; Abisko Research Station, Sweden, 2020 (canceled); One Ocean circumnavigation cruise, Statsraad Lehmkuhl, 2021, Rondane National Park, Norway, 2022.  
 Chair, MIT/WHOI Joint Program General Exam Committee, 2021, 2022  
 MIT/WHOI Joint Committee for Physical Oceanography, 2018 – present  
 MIT/WHOI Joint Program Admissions Advisory Committee, 2014 – 2015, 2022 – present  
 Summer Student Fellow Coordinator, Physical Oceanography, 2011 – 2013  
 American Museum of Natural History, instructor for class “The Ocean System”, 2008 – 2010

### *Student Advising*

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Brynnydd Hamilton, advisor, MIT/WHOI Joint Program student, 2021 – present  
 Anthony Meza, advisor, MIT/WHOI Joint Program student, 2021 – present  
 Cora Hersh, co-advisor, MIT/WHOI Joint Program student, 2019 – present  
 Theo Carr, Ph.D. thesis committee, MIT/WHOI, 2022 – present  
 Glenn Liu, Ph.D. thesis committee, MIT/WHOI, 2021 – present  
 Hanyuan Liu, Ph.D. thesis committee, MIT/WHOI, 2021 – 2023  
 Xabier Davila, Ph.D. co-advisor, University of Bergen, Norway, 2019 – 2023  
 Ailin Brakstad, Ph.D. co-advisor, University of Bergen, Norway, 2017 – 2023  
 Joleen Heiderich, Chair of the Ph.D. Defense, MIT/WHOI, 2021  
 Mariya Galochkina, Summer Student Fellow, 2019  
 Maya Chung, Summer Student Fellow, 2018  
 Greg Streletz, Ph.D. co-advisor, UC Davis, 2011 – 2018  
 Laura Fleming, M.S. co-advisor, Physical Oceanography, MIT/WHOI, 2017 – 2019  
 Celina Scott-Buechler, Summer Student Fellow, 2017  
 Marianna Linz, Ph.D. thesis committee, MIT/WHOI, 2014 – 2017  
 Ning Zhao, Chair of the Ph.D. Defense, MIT/WHOI, 2016  
 Yuxin Zhou, Summer Student Fellow, 2015  
 Daniel Amrhein, M.S. co-advisor, Physical Oceanography, MIT/WHOI, 2013  
 Alice Alpert, generals project advisor, Marine Geology & Geophysics, MIT/WHOI, 2013  
 Tsung-Lin Hsieh, Summer Student Fellow, 2013  
 Joseph Wenig, Summer Student Fellow, 2012  
 Fern Gibbons, Ph.D. thesis committee, Marine Geology & Geophysics, MIT/WHOI, 2012  
 Holly Dail, Ph.D. thesis committee, Physical Oceanography, MIT/WHOI, 2012

### *Postdoctoral Supervising*

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Duo Chan, 2021 – 2023  
 Thomas Chalk, 2015 – 2016

## Other Professional Activities

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### *Society Memberships:*

Member, American Geophysical Union  
 Member, Phi Beta Kappa  
 Member, Golden Key National Honor Society

### *Reviewer – 7 agencies and universities:*

National Environment Research Council (U.K.), National Oceanographic and Atmospheric Administration, National Science Foundation, University of Tasmania (Ph.D. thesis reviewer, 2020), WHOI Ocean and Climate Change Institute (panel member, 2015), WHOI internal awards (panel member, 2013), National Aeronautics and Space Administration (panel member, 2013)

### *Reviewer – 27 journals:*

Biogeosciences, Climate Dynamics, Earth and Planetary Science Letters, Environmental Research Letters, Environmental Science & Technology, Geochemistry Geophysics Geosystems, Geochimica et Cosmochimica Acta, Geophysical Research Letters, Geosciences, Geoscientific Model Development Discussions, Journal of Advances in Modeling Earth Systems, Journal of Atmospheric and Oceanic Technology, Journal of the Atmospheric Sciences, Journal of Climate, Journal of Geophysical Research-Atmospheres, Journal of Geophysical Research-Oceans, Journal of Marine Research, Journal of Marine Systems, Journal of Physical Oceanography, Nature, Nature Communications, Ocean Modelling, Paleoceanography, Quarterly Journal of the Royal Meteorological Society, Science, Science Advances, Tellus

*Community Activities:* Organizing Committee, Advanced Climate Dynamics Course, 2009 – present; Member, US CLIVAR Paleo-AMOC Task Team, 2018 – 2022; Working Group Member, PAGES (Past Global Changes) Ocean Circulation and Carbon Cycling (OC3), 2014 – 2018; Chair, American Geophysical Union Meeting Session, The Mid-Pleistocene transition, 2019; Chair, American Geophysical Union Ocean Sciences Meeting Session, Oceanic uptake of heat and greenhouse gases: Dynamic and thermodynamic controls and inferences from tracers, 2012; Chair, American Geophysical Union Ocean Sciences Meeting Session, The scientific and practical relevance of ocean data assimilation, 2010; Convener, American Geophysical Union Fall Meeting Session, General Physical Oceanography, 2005; Member, Estimating the Circulation and Climate of the Ocean (ECCO) Consortium, 1998 – 2004.

*WHOI Committees:* Joint Committee for Physical Oceanography, 2018 – present; Ocean Outlook Planning Committee, 2018 – present; Ocean Vital Signs Network initial framing committee, 2022; Workplace Climate Committee, 2018 – 2020; Defined Contribution Retirement Plan Committee, 2018 – 2021; Physical Oceanography Recruitment Committee, 2018 – 2019; Deputy Director and Vice President of Research search committee, 2019; Scientific Staff Executive Committee, 2015 – 2018; Ocean and Climate Change Institute (OCCI) advisory committee, 2015 – 2016; MIT-WHOI Joint Program Admissions committee, 2014 – 2016; Linda Morse-Porteus award selection committee, 2015; Advisory Committee for the WHOI high-performance computing, 2011 – 2015; Elected Member, MIT/WHOI Joint Program Alumni Association Committee, 2009 – 2015; Paleolunch Seminar Series Organizer, 2010 – 2013, Climate Initiative member and workshop organizer, 2011.



## Field Experience

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2001 R/V Oceanus Cruise 369, Reykjavik to Reykjavik, Iceland (Irminger Sea), 28 days at sea  
 2014 Glacial fieldwork, Disko Island, Greenland  
 2021 Statsraad Lehmkuhl tall ship, One Ocean Expedition, Miami to New York, 11 days at sea

## Recent and Invited Abstracts/Professional Talks

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- Gebbie, G., C. Wunsch, and Heimbach, P., 2002: "An eddy-resolving state estimate of the ocean circulation during the subduction experiment using a North Atlantic regional model (ECCO)," *Eos Trans. AGU*, AGU Fall Meet. Suppl., Abstract OS22F-13, San Francisco, CA, *Outstanding Student Paper Award*.
- Gebbie, G., C. Wunsch, and Heimbach, P., 2002: "An eddy-resolving state estimate of the ocean circulation during the subduction experiment using a North Atlantic regional model (ECCO)," World Ocean Circulation Experiment (WOCE) Meeting, San Antonio, TX, *Outstanding Student Poster Award*.
- Gebbie, G., and P. Huybers, 2006: "Meridional circulation during the Last Glacial Maximum explored through a combination of South Atlantic Delta-18-O observations and a geostrophic inverse model," *Eos Trans. AGU*, 87 (52), AGU Fall Meet. Suppl., Abstract PP34A-05, *invited presentation*, San Francisco, CA.
- Gebbie, G., and E. Tziperman, 2007: "The impact of ocean-modulated wind bursts on ENSO prediction," *solicited presentation*, European Geophysical Union Assembly, Vienna, Austria.
- Gebbie, G., and P. Huybers, 2008: "A reconstruction of ocean surface boundary conditions over the last millennium and beyond using observations of radiocarbon, conservative tracers, and nutrients," *Eos Trans. AGU*, 89 (53), American Geophysical Union Fall Meeting Suppl., Abstract PP52B-02, *invited presentation*, San Francisco, CA.
- Gebbie, G., 2008: "What is the age of the deep ocean? Interpretation of radiocarbon in a turbulent fluid," *invited presentations*, University of California, Santa Cruz and Scripps Institution of Oceanography.
- Gebbie, G., 2009: "The predictability of ocean-modulated westerly wind bursts and the implications for ENSO forecasts," *invited presentation*, Canadian Meteorological and Oceanographical Society Congress, Halifax, NS, Canada.
- Gebbie, G., 2009: "The imprint of climate change over the last millennium in modern-day ocean tracer distributions," *invited presentation*, University of Texas, Austin.
- Gebbie, G., 2010: "How is the ocean filled?: Connections between water masses and present and past climate," *invited presentations*, Woods Hole Oceanographic Institution, University of Arizona and University of Cambridge.

- Gebbie, G., 2011: "Tracking glacial ocean waters from surface source to seafloor: an inverse method applied to the last 25,000 years," *invited presentation*, European Geophysical Union Meeting, Vienna, Austria.
- Gebbie, G., 2011: "How Geochemical Proxies Provide Quantifiable Evidence of Climate Shifts Over the Last 25,000 Years," *keynote lecture*, Goldschmidt Conference, Prague, Czech Republic.
- Gebbie, G., 2012: "Interpreting Radiocarbon Observations with Many Surface Sources, with Application to Paleoceanographic Tracer Evolution," *invited seminar*, California Institute of Technology, Pasadena, CA.
- Gebbie, G., 2012: "Which Paleo Data Types Best Detect Past Circulation Changes?" *invited presentation*, The Paleoclimate Modeling Intercomparison Project, Phase 3; Comparing Ocean Models with Paleo-Archives 2012 (COMPARE 2012), Bremen, Germany.
- Gebbie, G., 2012: "Interpreting Radiocarbon Observations with Many Surface Sources, and Application to Paleoceanographic Tracer Evolution," *invited presentation*, Alfred Wegener Institute, Bremerhaven, Germany.
- Oppo, D.W., W.B. Curry, K.-F. Huang, G. Gebbie, and L.D. Keigwin, 2012: "Glacial-Holocene Deep Atlantic Variability," *invited presentation*, AGU Fall Meeting, San Francisco, CA, Abstract PP43C-05.
- Gebbie, G., 2013: "Just how different was the glacial ocean circulation?" *invited presentation*, Department of Earth System Science, University of California, Irvine, CA.
- Gebbie, G., 2014: "How much did Glacial North Atlantic Water shoal?" Harvard University ClimaTea series, *invited seminar*.
- Gebbie, G., 2015: "Keynote lecture: The North Atlantic window to the deep ocean reservoir," Ocean Outlook workshop, Bergen, Norway.
- Gebbie, G., 2016: "A poorly-ventilated Arctic Mediterranean and the demise of the Last Ice Age," Ocean Outlook meeting, Woods Hole, MA, *invited presentation*, April.
- Gebbie, G., 2016: "Connecting the ocean circulation of mass to the circulation of tracers: past and present," Goldschmidt Conference, Yokohama, Japan, *keynote lecture*.
- Gebbie, G., 2017: "A fossil water mass in today's ocean: Deep water from the Little Ice Age," Ocean Outlook meeting, Bergen, Norway, *keynote lecture*.
- Gebbie, G., A.R. Simms, and L.E. Lisiecki, 2018: "Ocean Density Changes and Deglacial Sealevel Rise," *oral presentation*, AGU Ocean Sciences Meeting, Portland, OR.
- Peterson, C., L.E. Lisiecki, and G. Gebbie, 2018: "Reconstructing carbon cycle and overturning changes since the LGM using benthic  $\delta^{13}\text{C}$ ," AGU Ocean Sciences Meeting, Portland, OR.
- Lauvset, S.K., L. Jiang, R. Feely, B. Carter, A. Olsen, S. van Heuven, A. Velo, F. Fiz Perez, R. Key, and G. Gebbie, 2018: "On the Spatial Variability of Ocean pH and its Primary

Drivers,” AGU Ocean Sciences Meeting, Portland, OR.

Gebbie, G., 2018: “Reconstructing Atlantic Temperature and Overturning over the last millennium,” US CLIVAR AMOC meeting, Miami, FL.

Gebbie, G., 2018: “The ocean as a three-dimensional borehole: Inverting subsurface temperature observations for the Common Era surface history,” poster, AGU Fall Meeting, Washington, DC.

Chung, M.V., G. Gebbie, and P.J. Huybers, 2018: “Quantifying isopycnal heave using dynamic depth warping,” poster, AGU Fall Meeting, Washington, DC.

Oppo, D.W., G. Gebbie, K.-F. Huang, W.B. Curry, T. Marchitto, K. Pietro, 2018: “Data constraints on glacial Atlantic water mass geometry and properties,” oral presentation, AGU Fall Meeting, Washington, DC.

Gebbie, G., 2019: Where are the missing microplastics?, *International Microplastics Workshop*, Woods Hole, MA.

Gebbie, G., 2019: Influence of the Ocean's Long Memory on the Air-Sea Heat Exchange of the Common Era, poster, *AGU Fall Meeting*, Abstract #566155, A21N-2758, San Francisco, CA.

Lacerra, M., D.C. Lund, G. Gebbie, D. Oppo, J. Yu, A. Schmittner, N. Umling, 2019: Less remineralized carbon in the intermediate depth South Atlantic during Heinrich Stadial 1, poster, *AGU Fall Meeting*, PP13B-1433, San Francisco, CA.

Galochkina, M., D. Oppo, G. Gebbie, D. Thornalley, L.D. Keigwin, 2019: Benthic d18O evidence for the transfer of Common Era surface temperature anomalies via North Atlantic Deep Water, poster, *AGU Fall Meeting*, PP43D-1626, San Francisco, CA.

Lee, T., L.E. Lisiecki, D. Rand, G. Gebbie, and C. Lawrence, 2019: A dual proxy Gaussian Process stack: Integrating benthic d18O and radiocarbon proxies for inferring ages on ocean sediment cores, poster, *AGU Fall Meeting*, PP23G-1658, San Francisco, CA.

Rand, D., L.E. Lisiecki, C. Lawrence, T. Lee, and G. Gebbie, Quantifying differences in the timing of deglacial d18O change to improve ocean circulation reconstructions, e-lightning presentation, *AGU Fall Meeting*, U11C-19, San Francisco, CA.

Moree, A.L., T. Sun, A. Bretones, E.O. Straume, K.H. Nisancioglu, and G. Gebbie, 2019: Cancellation of the precessional cycle in d18O records during the Early Pleistocene, oral presentation, *AGU Fall Meeting*, PP22B-01, San Francisco, CA.

Chung, M.V., G. Gebbie, and P.J. Huybers, 2020: Quantifying ocean heat content changes related to ENSO, seasonal variability, and trends in isopycnal heave, poster, *AGU Ocean Sciences Meeting*, PC24C-1799, San Diego, CA.

Davila, X., G. Gebbie, A. Brakstad, S. Lauvset, and A. Olsen, 2020: How is the ocean carbon reservoir filled?, oral presentation, *AGU Ocean Sciences Meeting*, OC33A-05, San Diego, CA.

- Brakstad, A., K. Vaage, G. Gebbie, and E. Jeansson, 2020: Tracing overflow water from the origin in the Nordic Seas to the Greenland-Scotland Ridge, oral presentation, *AGU Ocean Sciences Meeting*, HE33A-02, San Diego, CA.
- Gebbie, G., L. Cimoli, and S.G. Purkey, 2020: Mapping the decadal evolution of Antarctic Bottom Water ventilation from CFCs, poster, *AGU Ocean Sciences Meeting*, CT24A-0885, San Diego, CA.
- Lee, T., L.E. Lisiecki, D. Rand, G. Gebbie, and C. Lawrence: 2020, “A Nonparametric Hierarchical Stack Construction Algorithm for Benthic Oxygen Isotope Ratios Based on the Gaussian Process Regression,” poster, PP036-0011, AGU Fall Meeting.
- Rand, D., L.E. Lisiecki, T. Lee, C. Lawrence, and G. Gebbie: 2020, “Mapping Atlantic Benthic  $\delta^{18}\text{O}$  Lags During Termination 1,” oral presentation, PP038-0008, AGU Fall Meeting.
- Gebbie, G., L.E. Lisiecki, D. Rand, T. Lee, and C. Lawrence: 2020, “Modeling the Influence of Past Ocean Circulation Change of the Lags between Atlantic Benthic Oxygen-Isotope Records,” poster, PP036-0010, AGU Fall Meeting.
- Gebbie, G., D. Oppo, C. Ummenhofer, and W. Lu: 2021, “Ocean Shot Concept: Why paleoceanographic observations are needed to improve future climate projections,” U.S. Ocean Decade Launch meeting, presentation and poster.
- Bonanno, E., J. Wenegrat, U. Rack, and G. Gebbie, “A century of observed temperature changes in the Indian Ocean,” AGU Ocean Sciences meeting, poster presentation, 2022, session OC-06.
- \*\*Chan, D., G. Gebbie, and P. Huybers, “The coupling between coastal air and sea-surface temperatures and implications on historical SST reconstructions,” AGU Ocean Sciences meeting, oral presentation, 2022, session OD-02.
- Gebbie, G., \*A. Meza, and S. Wijffels, “Ocean heat content trends in the mid-depth ocean: ECCO state estimate case study,” AGU Ocean Sciences meeting, oral presentation, 2022, session OM-03.
- \*Hersh, C., S. Wijffels, and G. Gebbie, “Subtropical spice and potential vorticity anomalies: a global view of long-distance propagation in Argo and the ECCO Reanalysis,” AGU Ocean Sciences meeting, oral presentation, 2022, session PL-01.
- \*\*Cimoli, L., S. Purkey, G. Gebbie, and W. Smethie, “Reconstructing the multi-decadal propagation of CFCs and SF6 in the deep ocean from 1980-2020 observations,” AGU Ocean Sciences meeting, oral presentation, 2022, session PL-05.
- \*Davila, X., G. Gebbie, S. Lauvset, E. McDonagh, A. Brakstad, and A. Olsen, “Old and cold contributions to oxygen minimum zones,” EGU General Assembly meeting, oral presentation, 2022, Vienna, Austria, session OS1.4.

- \*\*Cimoli, L., S. Purkey, G. Gebbie, and W. Smethie, “Deep ocean steady-state transport and decadal variability inferred from 1980-2020 CFCs and SF6 observations,” EGU General Assembly meeting, oral presentation, 2022, Vienna, Austria, session OS1.1.**
- Lu, W., D.W. Oppo, B.R. Hamilton, and G. Gebbie, “The Little Ice Age cooling and 20th-century warming recorded in deep Northeast Atlantic sediments,” U.S. CLIVAR AMOC meeting, 2022, Woods Hole, MA.
- Rand, D., L.E. Lisiecki, G. Gebbie, T. Lee, C. Lawrence, 2022: “The benthic d18O lag between the eastern equatorial Pacific and the Iberian margin,” oral presentation, Chicago, IL, PP14C-02, AGU Fall Meeting.
- \*Hamilton, B.R., and G. Gebbie, W. Lu, D. Oppo, 2022: “Inverting benthic foraminiferal records for Little Ice Age surface climate evolution,” poster, Chicago, IL, PP45D-1180, AGU Fall Meeting.**
- Lu, W., D. Oppo, G. Gebbie, and D.J. Thornalley, 2022: “Rapid transmission of surface ocean signals to deep sea by Atlantic meridional overturning circulation during the last 1,000 years,” oral presentation, Chicago, IL, PP12B-08, AGU Fall Meeting.
- Zhou, Y., L.E. Lisiecki, D. Rand, B. Hobart, T. Lee, G. Gebbie, and C. Lawrence, 2022: “Revisiting Pleistocene benthic d18O stacks with BIGMACS,” oral presentation, Chicago, IL, PP11C-03, AGU Fall Meeting.
- Lisiecki, L.E., D. Rand, T. Lee, S. Newall, Y. Zhou, G. Gebbie, and C. Lawrence, 2022: “Evaluating probabilistic age models and stacks for different proxy types on the Iberian margin,” oral presentation, Chicago, IL, PP14C-01, AGU Fall Meeting.
- Jenkins, W.J., A. Seltzer, G. Gebbie, C.R. German, 2022: “The power of noble gases: Deep Pacific evidence for an intensifying Antarctic circumpolar trough over the Common Era,” oral presentation, Chicago, IL, PP56A-04.
- \*Meza, A., and G. Gebbie, 2022: “Drivers of mid-depth Pacific cooling trends in an ocean reanalysis,” poster, Chicago, IL, OS22C-0915.**
- Bowman, C., L.E. Lisiecki, D. Rand, T. Lee, G. Gebbie, and C. Lawrence, 2022: “A late Pleistocene planktonic d18O stack of the west Pacific warm pool,” poster, Chicago, IL, PP35C-0985.
- \*\*Chan, D., G. Gebbie, and P.J. Huybers, 2022: “Are we already at a 1.5C warming threshold: homogenized sea surface and land temperatures indicate between 1.2 and 1.5C warming from 1880 to 2022,” oral presentation, Chicago, IL, PP56A-01.**
- G. Gebbie, 2023: “Why the 20th Century needs to be understood in order to make climate projections”, WCRP Workshop: Improving climate models and projections using observations, Cambridge, MA, May, 2023.

G. Gebbie, and A. Meza, 2023: “Drivers of mid-depth Pacific cooling trends in an ocean reanalysis,” presentation, ECCO Workshop, Pasadena, CA, January, 2023.