

Rong Zhang

Senior Scientist

GFDL / NOAA

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History of Employment

- 2018 - Present* **Ocean and Cryosphere Division Head**, GFDL, NOAA
Supervisory Oceanographer, ZP-5, GFDL, NOAA
- 2016 - 2018* **Oceanographer**, ZP-5 (equivalent to university full professor),
GFDL, NOAA
- 2006 - 2016* **Oceanographer**, ZP-4, GFDL, NOAA
- 2015 - Present* **Lecturer**, AOS Program, Princeton University
- 2004 - 2006* **Associate Research Scholar**, AOS Program, Princeton University
- 2002 - 2003* **Postdoctoral Research Associate**, AOS Program, Princeton University

Degrees

- 2001 **Ph. D. Climate Physics and Chemistry**, MIT
- 1997 **M. A. Physics**, Boston University
- 1995 **B. E. Electronic Engineering**, Tsinghua University

Research Interests

Abrupt climate change and low frequency variability in the coupled ocean-atmosphere system, global teleconnections of climate change, impact of Atlantic meridional overturning circulation (AMOC) on global and regional climate change (such as Sahel, Indian, and East Asian monsoon, Atlantic Hurricane activity, Arctic sea ice, northern hemisphere mean surface temperature, North Pacific climate variability), meridional coherence and fingerprints of AMOC variability, mechanisms of Atlantic multidecadal variability (AMV)

Teaching Experience

- 2014 - Present* Lectures for graduate class AOS 573: Physical Oceanography,
AOS Program, Princeton University
- 2008 – 2014* Guest Lectures for graduate class AOS 577: Weather and Climate
Dynamics, Climates of the Earth: Present, Past, and Future, AOS
Program, Princeton University

Honor and Service to Community

Bernhard Haurwitz Memorial Lecturer, American Meteorological Society, 2020

Executive Board Member, CIMES, Princeton University, 2019-Present

Fellow, American Meteorological Society, 2018

Editor, *Journal of Climate*, 2016-Present
Science Advisory Board Member, Bjerknes Climate Prediction Unit, Bergen, Norway, 2018-Present
GFDL Science Board Member, 2018-Present; Research Council Member, 2014-2016
Chair, Scientific Organizing Committee, GFDL 2017 Science Symposium
Scientific Organizing Committee Member, US AMOC Science Team Meeting, Santa Fe, NM, 2017
Chair, US AMOC Task Team IV, 2016-2017; Vice-Chair, US AMOC Task Team IV, 2015-2016
Scientific Organizing Committee Member, International Paleo-AMOC Workshop, Boulder, CO, 2016
Scientific Organizing Committee Member, GFDL 60th Anniversary Symposium, Princeton, NJ, 2015
Scientific Steering Committee Member, RAPID/US AMOC International Science Meeting, Bristol, UK, 2015
US AMOC Executive Committee Member, 2010-2014, 2015-2017
Steering Committee Member, Model Development Team, GFDL, 2012-2017
Chair, US AMOC Task Team II, 2013-2014; Vice-Chair, US AMOC Task Team II, 2010-2013
Scientific Organizing committee Member, US AMOC Annual Meeting, Boulder, CO, 2012
US CLIVAR Phenomena, Observations, and Synthesis (POS) Panel Member, 2011-2013
Invited Contributing Author of IPCC AR5, 2011-2012
Convener, EGU General Assembly, Vienna, Austria, 2007
Session Chair/Co-Chair, AGU Ocean Sciences Meeting, Portland, OR, 2004, 2018
AGU Editors' Citation Award for Excellence in Refereeing for GRL, 2012

Professional Memberships

American Geophysical Union
American Meteorological Society

Publications

Menary, M., J. Robson, R. P. Allan, B. Booth, C. Cassou, G. Gastineau, J. M. Gregory, D. Hodson, C. Jones, J. Mignot, M. A. Ringer, R. Sutton, L. J. Wilcox, and **R. Zhang**, 2020, Aerosol-forced AMOC changes in CMIP6 historical simulations. *Geophysical Research Letters*. DOI:10.1029/2020GL088166.

Winton, M., A. Adcroft, J. P. Dunne, I. M. Held, E. Shevliakova, M. Zhao, H. Guo, W. Hurlin, J. Krasting, T. Knutson, D. Paynter, L. G. Silvers, and **R. Zhang**, 2020, Climate sensitivity of GFDL's CM4.0. *Journal of Advances in Modeling Earth Systems*, 12, <https://doi.org/10.1029/2019MS001838>.

Held, I. M., H. Guo, A. Adcroft, J. P. Dunne, L. W. Horowitz, J. Krasting, E. Shevliakova, M. Winton, M. Zhao, M. Bushuk, A. T. Wittenberg, B. Wyman, B. Xiang, **R.**

Zhang, W. Anderson, V. Balaji, L. Donner, K. Dunne, J. Durachta, P. P. G. Gauthier, P. Ginoux, J. C. Golaz, S. M. Griffies, R. Hallberg, L. Harris, M. Harrison, W. Hurlin, J. John, P. Lin, S. J. Lin, S. Malyshev, R. Menzel, P. C. D. Milly, Y. Ming, V. Naik, D. Paynter, F. Paulot, V. Rammasswamy, B. Reichl, T. Robinson, A. Rosati, C. Seman, L. G. Silvers, S. Underwood, N. Zadeh, 2019, Structure and performance of GFDL's CM4. 0 climate model. *Journal of Advances in Modeling Earth Systems*, 11, <https://doi.org/10.1029/2019MS001829>.

Adcroft, A, W. Anderson, V. Balaji, C. Blanton, M. Bushuk, C. O. Dufour, J. P. Dunne, S. M. Griffies, R. Hallberg, M. J. Harrison, I. M. Held, M. F. Jansen, J. G. John, J. P. Krasting, A. R. Langenhorst, S. Legg, Z. Liang, C. McHugh, A. Radhakrishnan, B. G. Reichl, T. Rosati, B. L. Samuels, A. Shao, R. Stouffer, M. Winton, A. T. Wittenberg, B. Xiang, N. Zadeh, **R. Zhang**, 2019, The GFDL global ocean and sea ice model OM4. 0: Model description and simulation features. *Journal of Advances in Modeling Earth Systems*, 11, <https://doi.org/10.1029/2019MS001726>.

Zhang, R., R. Sutton, G. Danabasoglu, Y. Kwon, R. Marsh, S. G. Yeager, D. E. Amrhein, and C. M. Little, 2019, A Review of the Role of the Atlantic Meridional Overturning Circulation in Atlantic Multidecadal Variability and Associated Climate Impacts, *Reviews of Geophysics*, DOI:10.1029/2019RG000644.

Yan, X., **R. Zhang**, and T. R. Knutson, 2019, A multivariate AMV index and associated discrepancies between observed and CMIP5 externally forced AMV. *Geophysical Research Letters*, 46, DOI:10.1029/2019GL082787.

Li, F., M. S. Lozier, G. Danabasoglu, N. P. Holliday, Y. Kwon, A. Romanou, S. G. Yeager, and **R. Zhang**, 2019, Local and downstream relationships between Labrador Sea Water volume and North Atlantic meridional overturning circulation variability. *Journal of Climate*, In Press.

Yan, X., **R. Zhang**, and T. R. Knutson, 2018, Underestimated AMOC variability and implications for AMV and predictability in CMIP models. *Geophysical Research Letters*, 45, DOI:10.1029/2018GL077378 .

Zhang, R., 2017, On the Persistence and Coherence of Subpolar Sea Surface Temperature and Salinity Anomalies Associated with the Atlantic Multidecadal Variability. *Geophysical Research Letters*, DOI:10.1002/2017GL074342.

Yan, X., **R. Zhang**, and T. R. Knutson, 2017, The role of Atlantic overturning circulation in the recent decline of Atlantic major hurricane frequency. *Nature*

Communications, 8, 1695, DOI:10.1038/s41467-017-01377-8 .

Li, D., **R. Zhang**, and T. R. Knutson, 2018, Comparison of Mechanisms for Low-Frequency Variability of Summer Arctic Sea Ice in Three Coupled Climate Models. *Journal of Climate*, 31, DOI:10.1175/JCLI-D-16-0617.1 .

Li, D., **R. Zhang**, and T. R. Knutson, 2017, On the Discrepancy between Observed and CMIP5 Multi-Model Simulated Barents Sea Winter Sea Ice Decline, *Nature Communications*, 8:14991, doi:10.1038/ncomms14991.

Smedsrud, L. H., M. H. Halvorsen, J. C. Stroeve, **R. Zhang**, and Kjell Kloster, 2017, Fram Strait sea ice export variability and September Arctic sea ice extent over the last 80 years. *The Cryosphere*, 11, 65-79, doi:10.5194/tc-11-65-2017.

Delworth, T. L., F. Zeng, L. Zhang, **R. Zhang**, G. A. Vecchi, 2017, The central role of ocean dynamics in connecting the North Atlantic Oscillation to the extratropical component of the Atlantic Multidecadal Oscillation, *Journal of Climate*, doi: 10.1175/JCLI-D-16-0358.1

Knutson, T. R., **R. Zhang**, and L. Horowitz, 2016, Prospects for a Prolonged Slowdown in Global Warming in the Early 21st Century, *Nature Communications*, 7, doi: 10.1038/ncomms13676.

Barcikowska, M., T. R. Knutson, and **R. Zhang**, 2016, Observed and simulated fingerprints of multidecadal climate variability, and their contributions to periods of global SST stagnation. *Journal of Climate*, 30, 721-737, doi:10.1175/JCLI-D-16-0443.1.

Zhang, R., R. Sutton, G. Danabasoglu, T. L. Delworth, W. M. Kim, J. Robson, and S. G. Yeager, 2016, Comment on "The Atlantic Multidecadal Oscillation without a role for ocean circulation". *Science*, 352, doi:10.1126/science.aaf1660.

Delworth, T. L., F. Zeng, G. A. Vecchi, X. Yang, L. Zhang, and **R. Zhang**, 2016, The North Atlantic Oscillation as a driver of rapid climate change in the Northern Hemisphere. *Nature Geoscience*, 9, doi:10.1038/ngeo2738.

Brown, P. T., S. Lozier, **R. Zhang**, and W. Li, 2016, The necessity of cloud feedback for a basin-scale Atlantic Multidecadal Oscillation. *Geophys. Res. Lett.*, 43, doi:10.1002/2016GL068303.

Saba, V. S., S. M. Griffies, W. G. Anderson, M. Winton, M. A. Alexander, T. L. Delworth, J. A. Hare, M. J. Harrison, A. Rosati, G. A. Vecchi, and **R. Zhang**, 2016, Enhanced warming of the northwest Atlantic Ocean under climate

change. *Journal of Geophysical Research*, 121,
doi:10.1002/2015JC011346.

Sanchez-Franks, A. and **R. Zhang**, 2015, Impact of the Atlantic meridional overturning circulation on the decadal variability of the Gulf Stream path and regional chlorophyll and nutrient concentrations, *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL066262.

Zhang J. and **R. Zhang**, 2015, On the evolution of Atlantic Meridional Overturning Circulation Fingerprint and implications for decadal predictability in the North Atlantic, *Geophys. Res. Lett.*, 42, doi:10.1002/2015GL064596.

Zhang, R. 2015, Mechanisms for low frequency variability of summer Arctic sea ice extent, *PNAS*, 112, doi: 10.1073/pnas.1422296112.

Zhang, R. 2015, Atlantic Meridional Overturning Circulation (AMOC) and Climate, Chapter 8 in the book "Climate Change: Multidecadal and Beyond", World Scientific Series on Asia-Pacific Weather and Climate, Vol. 6, pp125-140.

Keenlyside N. S., J. Ba, J. Mecking, N. Omrani, M. Latif, **R. Zhang**, R. Msadek, 2015, North Atlantic Multi-Decadal Variability –Mechanisms and Predictability, Chapter 9 in the book "Climate Change: Multidecadal and Beyond", World Scientific Series on Asia-Pacific Weather and Climate, Vol. 6, pp 141-158.

Griffies, S. M., M. Winton, W. G. Anderson, R. Benson, T. L. Delworth, C. O. Dufour, J. P. Dunne, P. Goddard, A. K. Morrison, A. T. Wittenberg, J. Yin, and **R. Zhang**, 2015, Impacts on ocean heat from transient mesoscale eddies in a hierarchy of climate models. *Journal of Climate*, 28, DOI:10.1175/JCLI-D-14-00353.1.

Msadek, R., T. L. Delworth, A. Rosati, W. G. Anderson, G. A. Vecchi, Y.-S. Chang, K. W. Dixon, R. Gudgel, W. F. Stern, A. T. Wittenberg, X.-Q. Yang, F. Zeng, **R. Zhang**, and S. Zhang, 2014, Predicting a Decadal Shift in North Atlantic Climate Variability Using the GFDL Forecast System. *Journal of Climate*, 27, DOI:10.1175/JCLI-D-13-00476.1.

Lynch-Stieglitz, J, M Schmidt, L G Henry, W B Curry, L C Skinner, S Mulitza, **R. Zhang**, and P. Chang, 2014, Muted change in Atlantic overturning circulation over some glacial-aged Heinrich events. *Nature Geoscience*, 7(2), DOI:10.1038/ngeo2045.

- Vecchi, G. A., R. Msadek, W. G Anderson, Y-S Chang, T. L. Delworth, K. W. Dixon, R. Gudgel, A. Rosati, W. F Stern, G. Villarini, A. T. Wittenberg, X. Yang, F. Zeng, **R. Zhang**, and S. Zhang, 2014, Reply to Comment on Multi-year Predictions of North Atlantic Hurricane Frequency: Promise and limitations. *Journal of Climate*, 27(1), DOI:10.1175/JCLI-D-13-00381.1.
- Zhang, R.**, and T. R. Knutson, 2013: The role of global climate change in the extreme low summer Arctic sea ice extent in 2012 [in "Explaining Extreme Events of 2012 from a Climate Perspective"]. *Bull. Amer. Meteor. Soc.*, 94 (9).
- Zhang, R.**, T. L. Delworth, R. Sutton, D. Hodson, K. W. Dixon, I. M. Held, Y. Kushnir, J. Marshall, Y. Ming, R. Msadek, J. Robson, A. Rosati, M. Ting, and G. A. Vecchi, 2013, Have Aerosols Caused the Observed Atlantic Multidecadal Variability?. *Journal of the Atmospheric Sciences*, 70, DOI:10.1175/JAS-D-12-0331.1.
- Vecchi, G. A., R. Msadek, W. G Anderson, Y-S Chang, T. L. Delworth, K. W. Dixon, R. Gudgel, A. Rosati, W. F Stern, G. Villarini, A. T. Wittenberg, X. Yang, F. Zeng, **R. Zhang**, and S. Zhang, 2013, Multi-year Predictions of North Atlantic Hurricane Frequency: Promise and limitations. *Journal of Climate*, 26, DOI:10.1175/JCLI-D-12-00464.1.
- Leech, P. J., J. Lynch-Stieglitz, and **R. Zhang**, 2013, Western Pacific Thermocline Structure and the Pacific Marine Intertropical Convergence Zone during the Last Glacial Maximum. *Earth and Planetary Science Letters*, 363, DOI:10.1016/j.epsl.2012.12.026.
- Lee, H. C., T. L. Delworth, A. Rosati, **R. Zhang**, W. G. Anderson, F. Zeng, C. A. Stock, A. Gnanadesikan, K. W. Dixon, and S. M. Griffies, 2013, Impact of climate warming on upper layer of the Bering Sea. *Climate Dynamics*, 40, DOI:10.1007/s00382-012-1301-8.
- Yang, X., A. Rosati, S. Zhang, T. L. Delworth, R. Gudgel, **R. Zhang**, G. A. Vecchi, W. G. Anderson, Y-S Chang, T. DelSole, K. W. Dixon, R. Msadek, W. F. Stern, A. T. Wittenberg, and F. Zeng, 2013, A predictable AMO-like pattern in GFDL's fully-coupled ensemble initialization and decadal forecasting system. *Journal of Climate*, 26, DOI:10.1175/JCLI-D-12-00231.1.
- Delworth, T. L., A. Rosati, W. G. Anderson, A. Adcroft, V. Balaji, R. Benson, K. W. Dixon, S. M. Griffies, H. C. Lee, R. C. Pacanowski, G. A. Vecchi, A. T. Wittenberg, F. Zeng, and **R. Zhang**, 2012, Simulated climate and climate change in the GFDL CM2.5 high-resolution coupled climate model. *Journal of Climate*, 25, DOI:10.1175/JCLI-D-11-00316.1

- Vecchi, G. A., R. Msadek, T. L. Delworth, K. W. Dixon, E. Guilyardi, E. Hawkins, A. R. Karspeck, J. Mignot, J. Robson, A. Rosati, and **R. Zhang**, 2012: Comment on "Multiyear Prediction of Monthly Mean Atlantic Meridional Overturning Circulation at 26.5°N". *Science*, 338(6107), DOI:10.1126/science.1222566.
- Zhang, R.**, T. L. Delworth, A. Rosati, W. G. Anderson, K. W. Dixon, H. C. Lee, and F. Zeng, 2011, Sensitivity of the North Atlantic Ocean circulation to an abrupt change in the Nordic Sea overflow in a high resolution global coupled climate model. *Journal of Geophysical Research*, 116, DOI:10.1029/2011JC007240
- Mahajan, S, **R. Zhang**, and T. L. Delworth, 2011, Impact of the Atlantic Meridional Overturning Circulation (AMOC) on Arctic surface air temperature and sea-ice variability. *Journal of Climate*, 24, DOI:10.1175/2011JCLI4002.1.
- Mahajan, S, **R. Zhang**, T. L. Delworth, S. Zhang, A. Rosati, and Y-S Chang, 2011, Predicting Atlantic meridional overturning circulation (AMOC) variations using subsurface and surface fingerprints. *Deep-Sea Research, Part II*, 58(17-18), DOI:10.1016/j.dsr2.2010.10.067.
- Wu, S, Z. Liu, **R. Zhang**, and T. L. Delworth, 2011: On the observed relationship between the Pacific Decadal Oscillation and the Atlantic Multi-decadal Oscillation. *Journal of Oceanography*, 67, DOI:10.1007/s10872-011-0003-x.
- Chen, M-T, X. Lin, Y. Chang, Y. Chen, L. Lo, C. Shen, Y. Yokoyama, D. W. Oppo, W. Thompson, and **R. Zhang**, 2010, Dynamic millennial-scale climate changes in the Northwestern Pacific over the past 40,000 years. *Geophysical Research Letters*, 37, L23603, doi:10.1029/2010GL045202.
- Zhang, R.**, 2010: Northward Intensification of Anthropogenically Forced Changes in the Atlantic Meridional Overturning Circulation (AMOC). *Geophysical Research Letters*, 37, L24603, doi:10.1029/2010GL045054.
- Zhang, R.**, 2010: Latitudinal dependence of Atlantic Meridional Overturning Circulation (AMOC) variations. *Geophysical Research Letters*, 37, L16703, doi:10.1029/2010GL044474.
- Joyce, T. M., and **R. Zhang**, 2010: On the path of the Gulf Stream and the Atlantic Meridional overturning circulation. *Journal of Climate*, 23, doi:10.1175/2010JCLI3310.1.

- Cheng, H, R. L. Edwards, W. S. Broecker, G. H. Denton, X. Kong, Y. Wang, **R. Zhang**, X. Wang., 2009: Ice age terminations. *Science*, 326, doi:10.1126/science.1177840.
- Zhang, R.**, S M Kang, and I. Held, 2010, Sensitivity of climate change induced by the weakening of the Atlantic Meridional Overturning Circulation to cloud feedback. *Journal of Climate*, 23, doi:10.1175/2009JCLI3118.1.
- Erukhimova, T, **R. Zhang**, and K P Bowman, 2009: The climatological mean atmospheric transport under weakened Atlantic thermohaline circulation climate scenario. *Climate Dynamics*, 32(2-3), 343-354.
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- Zhang, R.**, and T. L Delworth, 2009: A new method for attributing climate variations over the Atlantic Hurricane Basin's main development region. *Geophysical Research Letters*, 36, L06701, doi:10.1029/2009GL037260.
- Chang, P, **R. Zhang**, W Hazeleger, C. Wen, X Wan, L Ji, R J Haarsma, W-P Breugem, and H. Seidel, 2008: Oceanic link between abrupt changes in the North Atlantic Ocean and the African monsoon. *Nature Geoscience*, 1(7), 444-448.
- Delworth, T. L., P. U. Clark, M. Holland, W. E. Johns, T. Kuhlbrodt, J. Lynch-Stieglitz, C. Morrill, R. Seager, A. J. Weaver, and **R. Zhang**, 2008: The potential for abrupt change in the Atlantic Meridional Overturning Circulation In *Abrupt Climate Change: Final Report, Synthesis & Assessment Product 3.4*, CSSP, Reston, VA, U.S. Geological Survey, 117-162.
- Zhang, R.**, 2008: Coherent surface-subsurface fingerprint of the Atlantic meridional overturning circulation. *Geophysical Research Letters*, 35, L20705, doi:10.1029/2008GL035463.
- Delworth, T. L., **R. Zhang**, and M E Mann, 2007: Decadal to centennial variability of the Atlantic from observations and models In *Ocean Circulation: Mechanisms and Impacts, Geophysical Monograph Series 173*, Washington, DC, American Geophysical Union, 131-148.
- Schmittner, A, E D Galbraith, S W Hostetler, T F Pedersen, and **R. Zhang**, 2007: Large fluctuations of dissolved oxygen in the Indian and Pacific oceans during Dansgaard-Oeschger oscillations caused by variations of North Atlantic

Deep Water subduction. *Paleoceanography*, 22, PA3207, doi:10.1029/2006PA001384.

Zhang, R., T. L. Delworth, and I. Held, 2007: Can the Atlantic Ocean drive the observed multidecadal variability in Northern Hemisphere mean temperature? *Geophysical Research Letters*, 34, L02709, doi:10.1029/2006GL028683.

Zhang, R., 2007: Anticorrelated multidecadal variations between surface and subsurface tropical North Atlantic. *Geophysical Research Letters*, 34, L12713, doi:10.1029/2007GL030225.

Zhang, R., and G. K. Vallis, 2007: The role of bottom vortex stretching on the path of the North Atlantic Western Boundary Current and on the Northern Recirculation Gyre. *Journal of Physical Oceanography*, 37(8), 2053-2080.

Zhang, R., and T. L. Delworth, 2007: Impact of the Atlantic Multidecadal Oscillation on North Pacific climate variability. *Geophysical Research Letters*, 34, L23708, doi:10.1029/2007GL031601.

Zhang, R., and T. L. Delworth, 2006: Impact of Atlantic multidecadal oscillations on India/Sahel rainfall and Atlantic hurricanes. *Geophysical Research Letters*, 33, L17712, doi:10.1029/2006GL026267.

Zhang, R., 2006: How Cold Were the Tropics and Subtropics at the Last Glacial Maximum? *Quaternary Science Reviews*, 25, 1150-1151.

Zhang, R., and G. K. Vallis, 2006: Impact of Great Salinity Anomalies on the Low Frequency Variability of the North Atlantic Climate. *Journal of Climate*, 19, 470-482.

Zhang, R., and T. L. Delworth, 2005: Simulated Tropical Response to a Substantial Weakening of the Atlantic Thermohaline Circulation. Letter in *Journal of Climate*, 18, 1853-1860.

Griffies, S. M., A. Gnanadesikan, K. W. Dixon, J. P. Dunne, R. Gerdes, M. J. Harrison, A. Rosati, J. L. Russell, B. L. Samuels, M. J. Spelman, M. Winton, and **R. Zhang**, 2005: Formulation of an ocean model for global climate simulations. *Ocean Science*, 1, 45-79.

Gnanadesikan, A., K. W. Dixon, S. M. Griffies, V. Balaji, M. Barreiro, J. A. Beesley, W. F. Cooke, T. L. Delworth, R. Gerdes, M. J. Harrison, I. M. Held, W. J. Hurlin, H. Lee, Z. Liang, G. Nong, R. C. Pacanowski, A. Rosati, J. Russell, B. L. Samuels, Q. Song, M. J. Spelman, R. J. Stouffer, C. O. Sweeney, G.

Vecchi, M. Winton, A. T. Wittenberg, F. Zeng, **R. Zhang**, 2006. GFDL's CM2 Global Coupled Climate Models. Part II: The Baseline Ocean Simulation. *Journal of Climate*, 19, 675-697.

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Cessi, P., K. Bryan, and **R. Zhang**, 2004: Global Seiching of Thermocline Waters between the Atlantic and the Indian-Pacific Ocean Basins. *Geophysical Research Letters*, 31, L04302, doi:10.1029 / 2003GL019091.

Zhang, R., M. J. Follows and J. Marshall, 2003: Reply to Comment by Roberta M. Hotinski, Lee R. Kump, and Karen L. Bice on "Could the Late Permian Deep Ocean Have Been Anoxic?" *Paleoceanography*, 18(4), 1095, doi:10.1029/2002PA00851.

Zhang, R., M. J. Follows and J. Marshall, 2002: Mechanisms of Thermohaline Mode Switching with Application to Warm Equable Climates. *Journal of Climate*, 15, 2056-2072.

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Harrington, S., **R. Zhang**, P. H. Poole, F. Sciortino, and H. E. Stanley, 1997: Liquid-liquid Phase Transition: Evidence from Simulations, *Physical Review Letters*, 78: (12) 2409-2412.

Stanley H. E., L. Cruz, S. Harrington, P. H. Poole, S. Sastry, F. Sciortino, F. W. Starr, and **R. Zhang**, 1997: Cooperative Molecular Motions in Water: The Liquid-liquid Critical Point Hypothesis, *Physica A*, 236: (1-2) 19-37.

Conference Talks

Zhang, R., Invited talk: "Low-Frequency AMOC Variability and Associated Climate Impacts", at the AOML/GFDL Science Connections Workshop, August, 2020.

Zhang, R., Invited talk: “The Role of AMOC in Atlantic Decadal Predictability”, at the JpGU-AGU Virtual Joint Meeting, July, 2020.

Zhang, R., Invited talk: “Mechanisms for decadal climate predictability in the Atlantic-Arctic sector”, at the International Workshop on Climate Prediction in the Atlantic-Arctic Sector, Bergen, Norway, June, 2019.

Zhang, R., Invited talk: “The Atlantic Multidecadal Variability: Mechanism, Predictability, and Associated Impact on Hurricane Activity” at the 98th AMS Annual Meeting, Austin, TX, January, 2018.

Zhang, R., “Some Recent Applications of the Observed Extra-Tropical AMOC Fingerprint” at the 2018 International AMOC Science Meeting, Miami, FL, July, 2018.

Zhang, R., Invited talk: “The Atlantic multidecadal variability: Mechanism , Predictability, and the Associated Impact on Hurricane Activity” at Workshop on Atlantic Climate Variability-Dynamics, Prediction and Hurricane Risk, Columbia University, NYC, NY, September, 2017.

Zhang, R., Invited talk: “What we’ve learned from AMOC modeling efforts about AMOC processes and its role in weather and climate” at US CLIVAR Summit, Baltimore, MD, August, 2017.

Zhang, R., Invited talk: “Decadal variability and potential predictability in the Atlantic” at US CLIVAR Summit, Baltimore, MD, August, 2017.

Zhang, R., “Low-frequency variability in the North Atlantic-Arctic sector” at US AMOC Annual meeting, Santa Fe, NM, May, 2017.

Zhang, R., Invited talk: “Low Frequency Variability in the North Atlantic-Arctic Sector”, at the Fourth Santa Fe Climate Conference, Santa Fe, NM, February, 2017.

Zhang, R., Invited talk: “Mechanisms for low frequency variability and predictability in the North Atlantic Sector and Arctic” at Workshop on Climate Prediction in the Arctic-Atlantic Sector, Bergen, Norway, June, 2016.

Zhang, R., Invited talk: “The Atlantic Meridional Overturning Circulation: Paleo Aspects, Recent Behavior, and Abrupt Climate Change” at the Ronald J. Stouffer Symposium, Princeton, NJ, June, 2016.

Zhang, R., Invited talk: “AMOC Impacts on Climate” at International Paleo-AMOC

Workshop, Boulder, CO, May, 2016.

- Zhang, R.**, Invited talk: “The impact of low-frequency variability of the Atlantic on Arctic sea ice extent” at CLIVAR-ICTP International Workshop on Decadal Climate Variability and Predictability, Trieste, Italy, November, 2015.
- Zhang, R.**, Invited talk: “Ocean’s Role in Climate Change” at GFDL 60th Anniversary Symposium, Princeton, NJ, November, 2015.
- Zhang, R.**, Invited talk: “Impact of AMOC on the Low Frequency Variability of Summer Arctic Sea Ice Extent” at RAPID-US AMOC International Science Meeting, Bristol, UK, July, 2015.
- Zhang, R.**, Invited talk: “Impact of AMOC on Arctic sea ice and atmosphere heat transport into the Arctic” at 2014 US AMOC Science Team Meeting, Seattle, WA, September, 2014.
- Zhang, R.**, Invited talk: “Atlantic Meridional Overturning Circulation and Climate” at forum “The Role of Oceans in Multidecadal Climate Variability” Beijing, China, September, 2013.
- Zhang, R.**, Invited talk: “Atlantic Meridional Overturning Circulation and Climate” at Davos Atmosphere and Cryosphere Assembly 2013, Davos, Switzerland, July, 2013.
- Zhang, R.**, et al., Have Aerosols Caused the Observed Atlantic Multidecadal Variability? 2013 AMOC/ RAPID Meeting, Baltimore, MD, July, 2013.
- Zhang, R.**, Invited talk of AMOC Fingerprints at the 2012 US AMOC Annual meeting, mini-workshop of AMOC Fingerprints, Boulder, CO, August, 2012.
- Zhang, R.**, Invited talk: “Atlantic Meridional Overturning Circulation and Climate” at the National Taiwan University (NTU) International Science Conference on Climate Change, Taipei, Taiwan, September, 2012.
- Zhang R.**, Invited talk on the review of US AMOC Program at the 2011 US CLIVAR Summit, July, 2011, Woods Hole, MA.
- Zhang, R.**, et al., Atlantic Meridional Overturning Circulation (AMOC) Adjustment to an Abrupt Change in the Nordic Sea Overflow in a High Resolution Global Coupled Climate Model, RAPID/USAMOC International Science Meeting, July, 2011, Bristol, UK.

- Zhang R**, Latitudinal Dependence of Atlantic Meridional Overturning Circulation (AMOC) Variations, 2010 US Atlantic Meridional Overturning Circulation (AMOC) Annual Meeting, June, 2010, Miami, FL.
- Zhang R**, Invited talk "Observed and Modeled Fingerprints of the Atlantic Meridional Overturning Circulation". First U.S. Atlantic Meridional Overturning Circulation (AMOC) Annual Meeting, Annapolis, MD, May, 2009.
- Zhang R.** and T. L. Delworth, Invited talk "Impact of the Atlantic Multidecadal Oscillation on North Pacific Climate Variability". AGU Ocean Sciences Meeting, Orlando, FL, March, 2008.
- Zhang R.**, and T. L. Delworth, The impact of the Atlantic ocean variability on Indian summer monsoon rainfall. EGU General Assembly, Vienna, Austria, April, 2007.
- Zhang R.**, and T. L. Delworth, Simulated Tropical Response to a Substantial Weakening of the Atlantic Thermohaline Circulation. *U.S. CLIVAR Atlantic Science Conference*, Miami, FL, February 2005
- Zhang R.**, and G. Vallis, The Great Salinity Anomalies Events and the Low Frequency Variability in the North Atlantic. *AGU Ocean Sciences Meeting*, Portland, OR, January, 2004.
- Zhang R.**, M. Follows and J. Marshall, Self-sustained Thermohaline Oscillations in Paleo Oceans. *AMS 13th Conference on Atmospheric and Oceanic Fluid Dynamics*, Breckenridge, CO, June, 2001.
- Zhang R.**, M. Follows, J. P. Grotzinger and J. Marshall, Modeling Circulation and Biogeochemical Cycles in the Late Permian Ocean. *AGU Ocean Sciences Meeting*, San Antonio, TX, January, 2000.