Hiroyuki Murakami

Curriculum Vitae
September 22, 2022

Project Scientist II, University Corporation for Atmospheric Research (UCAR)/Geophysical Fluid Dynamics Laboratory (GFDL)
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RESEARCH OBJECTIVES

- Tropical Cyclone
- Extreme Event and Attribution
- Climate Variability and Predictability
- Seasonal Predictions
- Numerical Weather Predictions
- Risk Assessment
- Deep Learning

EDUCATION

2011 Ph. D. Graduate School of Life and Environmental Sciences, Tsukuba University, Tsukuba, Japan
2000 M.S., Environmental Sciences, Tsukuba University, Tsukuba, Japan
1998 B.S., Atmospheric Sciences, Tsukuba University, Tsukuba, Japan

Ph. D. Dissertation: Tropical Cyclone Climate Projections by 20-km mesh MRI/JMA Atmospheric General Circulation Model

PROFESSIONAL APPOINTMENTS

- Project Scientist II, University Corporation for Atmospheric Research (UCAR)/ Geophysical Fluid Dynamics Laboratory (GFDL), Princeton, NJ, USA, 2019–Present
- Project Scientist I, University Corporation for Atmospheric Research (UCAR)/ Geophysical Fluid Dynamics Laboratory (GFDL), Princeton, NJ, USA, 2018
- Associate Research Scholar, Princeton University, Atmospheric and Oceanic Sciences (AOS)/Geophysical Fluid Dynamics Laboratory (GFDL), Princeton, NJ, USA, 2014 – 2018
- Postdoctoral Fellow, International Pacific Research Center (IPRC)/University of Hawaii, Honolulu, HI, USA, 2012–2014
- Visiting Scientist, Meteorological Research Institute (MRI), Tsukuba, Ibaraki, Japan, 2012–2021
- Research Fellow, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan, 2010–2012
- Research Fellow, Advanced Earth Science & Technology Organization (AESTO) /Meteorological Research Institute, Japan (MRI), 2007–2010
- Professional Engineer on Environmental Assessment, Center for Environmental Information Science Corp, 2007
- Research Fellow, Advanced Earth Science & Technology Organization (AESTO)/Japan Meteorological Agency, Japan, 2002–2007

- Professional Engineer on Environmental Assessment, Asia Air Survey Co., Ltd., 2000–2002

ACADEMIC ACTIVITY

- International Workshop on Tropical Cyclones (IWTC-10), Rapporteur,2022–Present
- US CLIVAR Hurricane Working Group, Contributing Member, 2012–2014
- IPCC 5th Assessment Report, Contributing Author, 2011-2013
- American Geophysical Society, 2010-Present
- American Meteorological Society, 2010-Present
- Japan Meteorological Society, 2004-Present

PUBLICATIONS

Total number of publications: 109, First author papers: 27
Total citation number: 7,460, H-index: 45

Books

Chu, P. and **H. Murakami,** 2022: "Climate variability and tropical cyclone activity.", Cambridge Academy Press.

Refereed Journal Articles (* indicates advised student paper)

In Press

2022

[1] Chand, S. S., K. J. E. Walsh, S. J. Camargo, J. Kossin, K. J. Tory, M. F. Wehner, J. C. L. Chan, P. J. Klotzbach, A. J. Dowdy, S. S. Veli, H. A. Ramsay, and **H. Murakami**, 2022: Declining numbers of tropical cyclones and global warming *Nat. Clim. Change*, **12,** 655-661.

[2] Bushuk, M., Y. Zhang, M. Winton, B. Hurlin, T. Delworth, F. Lu, L. Jia, L. Zhang, W. Cooke, M. Harrison, N. C. Johnson, S. Kapnick, C. McHugh, **H. Murakami**, A. Rosati, K. Tseng, A. T. Wittenberg, X. Yang, and F. Zeng, 2022: Mechanisms of regional Arctic sea ice predictability in two dynamical seasonal forecast systems. *J. Climate*, **35,** 4207-4231.

[3] Jia, L., T. L. Delworth, S. Kapnick, X. Yang, N. Johnson, W. Cooke, F. Lu, M. Harrison, A. Rosati, F. Zeng, C. McHugh, A. T. Wittenberg, L. Zhang, **H. Murakami**, and K. Tseng, 2021: Skillful seasonal prediction of North American summertime heat extremes. *J. Climate*, **35,** 4331-4345.

[4] **Murakami, H.**, T. L. Delworth, W. F. Cooke, S. B. Kapnick, and P. -C. Hsu, 2022: Increasing frequency of extreme precipitation events in Japan due to global warming. *Earth's Future*, **10,** e2021EF002481.

[5] **Murakami, H.**, 2022: "Tropical cyclones in changing climate.," in *Handbook on Air Quality and Climate Change.*, Akimoto, H., Ed., Springer.

[6] **Murakami, H.**, 2022: Substantial global influence of anthropogenic aerosols on tropical cyclones over the last 40 years. *Sci. Adv.*, **8,** eabn9493.

[7] **Murakami, H**. and B. Wang, 2022: Patterns and frequency of projected future tropical cyclone genesis are governed by dynamic effects. *Commun. Earth Environ.*, **3,** 77.

[8] Nasuno, T., M. Nakano, **H. Murakami**, K. Kikuchi, and Y. Yamada, 2022: Impacts of midlatitude western North Pacific sea surface temperature anomaly on the subseasonal to seasonal tropical cyclone activity: case study of the 2018 boreal summer. *SOLA*, **18**, 88-95.

[9] Tseng, K., N. C. Johnson, S. B. Kapnick, W. Cooke, T. L. Delworth, L. Jia, F. Lu, C. McHugh, **H. Murakami**, A. J. Rosati, A. T. Wittenberg, X. Yang, F. Zeng, and L. Zhang, 2022: When will humanity notice its influence on atmospheric rivers? *J. Geophys. Res.*, **127**, e2021JD036044.

[10] Zhang, L., T. L. Delworth, S. Kapnick, J. He, W. Cooke, A. T. Wittenberg, N. C. Johnson, A. Rosati, X. Yang, F. Lu, M. Bushuk, C. McHugh, **H. Murakami**, F. Zeng, L. Jia, K. Tseng, and Y. Morioka, 2022: Roles of Meridional Overturning in Subpolar Southern Ocean SST Trends: Insights from Ensemble Simulations. *J. Climate,* **35,** 1577-1596.

2021

[11] Aarons, Z., S. J. Camargo, J. D. O. Strong, and **H. Murakami,** 2021: Tropical cyclone characteristics in the MERRA-2 reanalysis and AMIP simulations. *Earth Space Sci.*, **8,** e2020EA001415.

[12] Bushuk, M., M. Winton, A. F. Haumann, T. Delworth, F. Lu, Y. Zhang, L. Jia, L. Zhang, W. Cooke, M. Harrison, B. Hurlin, N. C. Johnson, S. Kapnick, C. McHugh, **H. Murakami,** A. Rosati, K. Tseng, A. T. Wittenberg, X. Yang, and F. Zeng, 2021: Seasonal prediction and predictability of regional Antarctic sea ice. *J. Climate,* **34.** 6207-6233.

[13] Chen, J., C. Tam, K. Cheung, Z. Wang, **H. Murakami**, N. Lau, S. T. Garner, Z. Xiao, C. Choy, and P. Wang, 2021: Changing impacts of tropical cyclones on East and Southeast Asian inland regions in the past and a globally warmed future climate. *Front. Earth Sci.*, **9**, 769005.

[14] Hsu, P. -C., **H. Murakami,** J. -Y. Lee, C. Yoo, N. C. Johnson, C. -H. Chang, and Z. Fu, 2021: Summertime east Antarctic cooling induced by decadal changes in Madden-Julian Oscillation. *Sci. Adv.*, **7,** eebf9903.

[15] *Kim, D., C. Ho, **H. Murakami,** and D. R. Park, 2021: Assessing the influence of large-scale environmental conditions on rainfall structure of Atlantic tropical cyclones: An observational study. *J. Climate,* **34,** 2093-2106.

[16] Ma, H., C. A. Siongco, S. A. Klein, S. Xie, A. R. Karspeck, K. Raeder, J. L. Anderson, J. Lee, B. P. Kirtman, W. J. Merryfield, **H. Murakami**, and J. J. Tribbia, 2020: On the correspondence between seasonal forecast and long-term climate errors in sea surface temperatures. *J. Climate*, **34,** 427-446.

[17] Tseng, K., N. C. Johnson, S. B. Kapnick, T. L. Delworth, F. Lu, W. Cooke, A. T. Wittenberg, A. J. Rosati, L. Zhang, C. McHugh, X. Yang, M. Harrison, F. Zeng, G. Zhang, **H. Murakami**, M. Bushuk, and L. Jia, 2021: Are multiseasonal forecasts of atmospheric rivers possible? *Geophys. Res. Lett.*, **48**, e2021GL094000.

[18]*Zhang, G., H. Murakami, X. Yang, K. L. Findell, A. T. Wittenberg, and L. Jia, 2021: Dynamical seasonal predictions of tropical cyclone activity: Roles of sea surface temperature errors and atmosphere-land initialization. *J. Climate*, **34,** 1743-1766.

[19]*Zhang, G., **H. Murakami**, W. F. Cooke, Z. Wang, L. Jia, F. Lu, X. Yang, T. L. Delworth, A. T. Wittenberg, M. J. Harrison, M. Bushuk, C. McHugh, N. C. Johnson, S. B. Kapnick, K. Tseng, and L. Zhang, 2021: Seasonal predictability of baroclinic wave activity. *npj Clim. Atmos.*, **4**, 50.

2020

[20]Bieli, M., A. H. Sobel, S. J. Camargo, **H. Murakami**, and G. A. Vecchi, 2020: Application of the cyclone phase space to extratropical transition in a global climate model. *J. Adv. Model. Earth Syst.*, **12**, e2019MS001878.

[21]Camargo, S., C. Giulivi, A. Sobel, A. Wing, D. Kim, Y. Moon, J. Strong, A. D. Genio, M. Kelley, **H. Murakami**, K. Reed, E. Scoccimarro, G. Vecchi, M. Wehner, C. Zarzycki, and M. Zhao, 2020: Characteristics of model tropical cyclone climatology and the large-scale environment. *J. Climate*, **33**, 4463-4487.

[22]Delworth, T. L., W. F. Cooke, A. A. Adcroft, M. Bushuk, J. Chen, K. A. Dunne, P. Ginoux, R. Gudgel, R. W. Hallberg, L. Harris, M. J. Harrison, N. Johnson, S. B. Kapnick, S. Lin, F. Lu, S. Malyshev, P. C. Milly, **H. Murakami**, V. Naik, S. Pascale, D. Paynter, A. Rosati, M. D. Schwarzkopf, E. Shevliakova, S. Underwood, A. T. Wittenberg, B. Xiang, X. Yang, F. Zeng, H. Zhang, L. Zhang, and M. Zhao, 2020: SPEAR – the next generation GFDL modeling system for seasonal to multidecadal prediction and projection. *J. Adv. Model. Earth Syst.*, **12**, e2019MS001895.

[23]Hsu, P. -C., Y. Qian, Y. Liu, **H. Murakami**, and Y. Gao, 2020: Role of abnormally enhanced MJO over the Western Pacific in the formation and subseasonal predictability of the record-breaking Northeast Asian heatwave in the summer of 2018. *J. Climate*, **33**, 3333-3349.

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[25]**Murakami, H.**, T. L. Delworth, W. F. Cooke, M. Zhao, B. Xiang, and P. -C. Hsu, 2020: Detected climatic change in global distribution of tropical cyclones. *Proc. Natl. Acad. Sci. U.S.A.*, **117(20)**, 10706-10714.

[26]Qian, Y., P. -C. Hsu, **H. Murakami**, B. Xiang, and L. You, 2020: A hybrid dynamical-statistical model that advances the subseasonal tropical cyclone prediction over the western North Pacific. *Geophys. Res. Lett.*, 47, e2020GL090095.

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[28] Wang, B. and **H. Murakami**, 2020: Dynamic genesis potential index for diagnosing present-day and future global tropical cyclone genesis. *Environ. Res. Lett.*, **15,** 114008.

[29] Zhang, G., **H. Murakami,** T. R. Knutson, R. Mizuta, and K. Yoshida, 2020: Tropical cyclone motion in a changing climate. *Sci. Adv.*, **6(17)**, eaaz7610.

2019

[30]Bhatia, K. T., G. A. Vecchi, T. Knutson, **H. Murakami,** J. Kossin, K. Dixon, and C. Whitlock, 2019: Recent increases in tropical cyclone intensification rates. *Nat. Commun.*, **10**, 635.

[31]González-Alemán, J. J., S. Pascale, J. Gutierrez-Fernandez, **H. Murakami,** M. A. Gaertner, and G. A. Vecchi, 2019: Potential increase in hazard from Mediterranean hurricane activity with global warming. *Geophys. Res. Lett.*, **46**, 1754-1764.

[32]Klotzbach, P. J., E. Blake, J. Camp, L. Caron, J. Chan, N. Kang, Y. Kuleshov, S. Lee, **H. Murakami,** M. Saunders, M. Saunders, Y. Takaya, and F. Vitart, and Rufen Zhan, 2019: Seasonal Tropical Cyclone Forecasting. *Trop. Cyclone Res. Rev.*, **8(3)**, 134-149.

[33]* Levin, E. L., and **H. Murakami,** 2019: Impact of anthropogenic climate change on United States major hurricane landfall frequency. *J. Mar. Sci. Eng.*, **7(5)**, online published.

[34]* Qian, Y., **H. Murakami,** M. Nakano, P. -C. Hsu, T. L. Delworth, S. B. Kapnick, V. Ramaswamy, T. Mochizuki, Y. Morioka, T. Doi, T. Kataoka, T. Nasuno, and K. Yoshida, 2019: On the mechanisms of the active 2018 tropical cyclone season in the North Pacific. *Geophys. Res. Lett*., **46,** 12293-12302.

[35]Tan, K., P. Huang, F. Liu, **H. Murakami,** and P. -C. Hsu, 2019: Simulated ENSO's impact on tropical cyclone genesis over the western North Pacific in CMIP5 models and its changes under global warming. *Int. J. Climatol.*, online published.

[36]Vecchi, G. A., T. Delworth, **H. Murakami,** S. Underwood, A. T. Wittenberg, F. Zeng, W. Zhang, J. W. Baldwin, K. Bhatia, W. Cooke, J. He, S. B. Kapnick, T. Knutson, G. Villarini, K. van der Wiel, W. Anderson, V. Balaji, J. Chen, K. Dixon, R. Gudgel, L. Harris, L. Jia, N. Johnson, S. Lin, M. Liu, J. Ng, A. Rosati, J. Smith, and X. Yang, 2019: Tropical cyclone sensitivities to CO2 doubling: roles of atmospheric resolution, synoptic variability and background climate changes. *Clim. Dyn.*, **53(9-10),** 5999-6033.

[37]Walsh, K. J. E., S. Camargo, T. R. Knutson, J. Kossin, T. -C. Lee, **H. Murakami,** and C. Patricola, 2019: Tropical cyclones and climate change. *Trop. Cyclone Res. Rev.*, **8(4),** 240-250.

[38]Wing, A.A., S.J. Camargo, A.H. Sobel, D. Kim, Y. Moon, **H. Murakami,** K.A. Reed, G.A. Vecchi, M.F. Wehner, C. Zarzycki, and M. Zhao, 2019: Moist static energy budget analysis of tropical cyclone formation and intensification in high-resolution climate models. *J. Climate*, **32**, 6071-6095.

[39]*Zhang, G., **H. Murakami**, R. Gudgel, and X. Yang, 2019: Dynamical seasonal prediction of tropical cyclone activity: Robust assessment of prediction skill and predictability. *Geophys. Res. Lett.*, **46,** 5506-5515.

[40]Zhang, W., G. Villarini, G. A. Vecchi, and **H. Murakami,** 2019: Rainfall from Tropical Cyclones: High-resolution Simulations and Seasonal Forecasts. *Clim. Dyn.*, **52(9-10)**, 5269-5289.

2018

[41]Bhatia, K. T., G. A. Vecchi, **H. Murakami,** S. Underwood, and J. Kossin, 2018: Projected response of tropical cyclone intensity and intensification in a global climate model. *J. Climate,* **31,** 8281–8303.

[42]Kim, D., Y. Moon, S. J. Camargo, A. A. Wing, A. H. Sobel, **H. Murakami,** G. A. Vecchi, M. Zhao, and E. Page, 2018: Process-oriented diagnosis of tropical cyclones in high-resolution GCMs. *J. Climate*, **31,** 1685–1702.

[43]Liu, M., G. A. Vecchi, J. A. Smith, and **H. Murakami,** 2018: Projection of landfalling tropical cyclone rainfall in the eastern United States under anthropogenic warming. *J. Climate,* **31,** 7269–7286.

[44]Liu, M., G. A. Vecchi, J. A. Smith, **H. Murakami,** R. Gudgel, and X. Yang, 2018: Towards dynamical seasonal forecast of extratropical transition in the North Atlantic. *Geophys. Res. Lett.,* 45, 12602–12609.

[45]**Murakami, H.,** E. Levin, T. L. Delworth, R. Gudgel, and P. -C. Hsu, 2018: Dominant effect of relative tropical Atlantic warming on major hurricane occurrence. *Science,* **362**, 794-799.

[46]Ng, C. H. J., G. A. Vecchi, A. G. Munoz, and **H. Murakami,** 2018: The nonlinearity of rainfall response to ENSO in East Asia. *Clim. Dyn.*,**52(3–4),** 2303–2318.

[47]Zhang, W., G. Villarini, G. A. Vecchi, **H. Murakami,** R. Gudgel, and X. Yang, 2018: Impact of the Pacific Meridional Mode on landfalling North Atlantic tropical cyclones. *Clim. Dyn.*, **50,** 991–1006.

[48]Zhang, W., G. A. Vecchi, **H. Murakami,** G. Villarini, T. L. Delworth, X. Yang, and L. Jia, 2018: Dominant role of Atlantic Multidecadal Oscillation in the recent decadal changes in Western North Pacific tropical cyclone activity. *Geophys. Res. Lett.*, **45,** 354–362.

2017

[49]Liu, M., G. A. Vecchi, J. A. Smith, and **H. Murakami,** 2017: The present-day simulation and twenty-first-century projection of the climatology of extratropical transition in North Atlantic. *J. Climate*, **30**, 2739–2756.

[50]**Murakami, H.,** G. A. Vecchi, T. L. Delworth, A. T. Wittenberg, S. Underwood, R. Gudgel, X. Yang, L. Jia, F. Zeng, K. Paffendorf, and W. Zhang, 2017: Dominant role of subtropical Pacific warming on the extreme 2015 central Pacific hurricane season. *J. Climate,* **30,** 243–264.

[51]**Murakami, H.,** G. A. Vecchi, and S. Underwood, 2017: Increasing frequency of extremely severe cyclonic storms over the Arabian Sea. *Nature Climate Change*, **7,** 885–889.

[52]Nakamura, J., S. J. Camargo, A. H. Sobel, N. Henderson, K. A. Emanuel, A. Kumar, T. E. LaRow, **H. Murakami,** M. J. Roberts, E. Scoccimarro, P. L. Vidale, H. Wang, M. F. Wehner, and M. Zhao, 2017: Western North Pacific tropical cyclone model tracks in present and future climates. *J. Geophys. Res.*, **122**, 9721–9744.

[53]Pascale, S., W. R. Boos, S. Bordoni, T. L. Delworth, S. B. Kapnick, **H. Murakami,** G. A. Vecchi, and W. Zhang, 2017: Weakening of the North American monsoon with global warming. *Nature Climate Change*, **7**, 806–812.

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2016

[57]Krishnamurthy, L., G. A. Vecchi, R. Msadek, **H. Murakami,** A. Wittenberg, and F. Zeng, 2016: Impact of strong ENSO on regional tropical cyclone activity in a high-resolution climate model. *J. Climate*, **29,** 2375–2394.

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[59]**Murakami, H.,** G. Villarini, G. A. Vecchi, W. Zhang, and R. Gudgel, 2016: Statistical-dynamical seasonal forecast of North Atlantic and U.S. landfalling tropical cyclones using the high-resolution GFDL FLOR coupled model. *Mon. Wea. Rev.*, **144,** 2101–2123.

[60]Ogata, T., R. Mizuta, Y. Adachi, H. Murakami, and T. Ose, 2016: Atmosphere-ocean coupling effect on intense tropical cyclone distribution and its future change with 60km-AOGCM. *Scientific Report*, **6**, 29800.

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[62]Sugi, M., H. Murakami, and K. Yoshida, 2016: Projection of future changes in the frequency of intense tropical cyclones. *Clim. Dyn.*, online published.

[63]Van der Wiel, K., S. B. Kapnick, G. A. Vecchi, W. F. Cooke, T. L Delworth, L. Jia, H. Murakami, S. Underwood, and F. Zeng, 2016: The resolution dependence of contiguous US precipitation extremes in response to CO2 forcing. *J. Climate*, **29,** 7911–8012.

[64]Zhang, W., G. A. Vecchi, **H. Murakami**, T. Delworth, A.T. Wittenberg, A. Rosati, S. Underwood, W. Anderson, L. Harris, R. Gudgel, S.-J. Lin, G. Villarni, and J.-H. Chen, 2016: Improved simulation of tropical cyclone responses to ENSO in the western North Pacific in the high-resolution GFDL HiFLOR coupled climate model. *J. Climate,* **29,** 1391–1415.

[65]Zhang, W., G. A. Vecchi, **H. Murakami**, G. Villarini, and L. Jia, 2016: The Pacific meridional mode and the occurrence of tropical cyclones in the western North Pacific. *J. Climate*, **29,** 381–398.

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2015

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2014

[76]Horn, M., K. Walsh, M. Zhao, S. A. Camargo, E. Scoccimarro, **H. Murakami**, H. Wang, D. Shaevitz, J. A. Jonas, D. Kim, K. Oouchi, K. Emanuel, and M. Roberts, 2014: Tracking scheme dependence of simulated tropical cyclone response to idealized climate simulations. *J. Climate*, **27**, 9197–9213.

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[86]Sugi, M., **H. Murakami**, and J. Yoshimura, 2014: "Mechanism of the Indian Ocean Tropical Cyclone Frequency Changes due to Global Warming.," in *Monitoring and Prediction of Tropical Cyclones in the Indian Ocean and Climate Change.*, Mohanty, U. C., M. Mohapatra, O. P. Singh, B. K. Bandyopadhyay, and L. S. Rathore, Eds., Springer, 40-49.

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2012

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2011

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2010

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[104] **Murakami, H** and M. Sugi, 2010: Effect of model resolution on tropical cyclone climate projections. *SOLA*, **6**, 073–076.

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Before 2010

[107] Sugi, M., **H. Murakami**, and J. Yoshimura, 2009: A reduction in global tropical cyclone frequency due to global warming. *SOLA*, **5**, 164–167.

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Book Chapters

Murakami, H., M. Sugi, and A. Kitoh, 2014: "Future changes in tropical cyclone activity in the North Indian Ocean projected by the new high-resolution MRI-AGCMs.," in *Monitoring and Prediction of Tropical Cyclones in the Indian Ocean and Climate Change.*, Mohanty, U. C., M. Mohapatra, O. P. Singh, B. K. Bandyopadhyay, and L. S. Rathore, Eds., Springer, 65–71.

Murakami, H., and T. Matsumura, 2004: Introduction of Vertical Normal Mode Incremental Initialization for a High-Resolution Global Model. *CAS/JSC WGNE Research Activities in Atmospheric and Oceanic Modeling*, **34,** 23–24

Manuscripts Submitted

- Bhatia, K., A. Baker, W. Yang, B. Vecchi, T. Knutson, **H. Murakami**, J. Kossin, K. Hodges, K. Dixon, C. Whitlock, P. L. Vidale, and B. Bronselaer, 2022: Tropical cyclone rapid intensification: An explanation for the global increase *Nat. Commun.*, under review.
- Huang, M., Q. Wang, M. Liu, N. Lin, Y. Wang, R. Jing, J. Sun, **H. Murakami**, and W. Lou, 2022: Increasing typhoon impact and losses due to anthropogenic warming in Southeast China. *Sci. Rep.*, submitted.
- Jong, B., T. L. Delworth, W. Cooke, K. Tseng, and **H. Murakami**, 2022: Increases in extreme precipitation over the Northeast United States using high-resolution climate model simulations. *Nat. Clim. Change*, submitted.
- Tseng, K., N. C. Johnson, A. T. Wittenberg, T. L. Delworth, S. Lee, H. Lopez, D. Kim, A. Kumar, H. Wang, F. Lu, W. Cooke, Anthony, J. Rosati, L. Zhang, C. McHugh, X. Yang, M. Harrison, F. Zeng, **H. Murakami**, M. Bushuk, and L. Jia, 2022: Skillful forecasts of springtime CONUS tornado activity up to a year in advance *Sci. Adv.*, submitted.

AWARDS AND ACCOMPLISHMENTS

2021 Reuters List of Top 1000 Climate Researchers (Rank: 483)

2020 UCAR Outstanding Accomplishment Awards

2016 GFDL outstanding scientific paper award

2016 Outstanding paper awarded in the climate variations and predictability group at GFDL

2013 Cover Article on the *Nature Climate Change*

2012 Highlighted on *Nature*

2012 The best paper award, coastal engineering award, JSCE

2011 Plaque for the outstanding keynote lecturer at the opening session of the 5th Korea-Japan-China Joint Conference on Meteorology. Awarded by the Korean Meteorological Society

INVITED TALKS

- "Identifying United States hurricane risk with changing climate," in *Symposium on hurricane risk in a changing climate*, Baker's Cay, Key Largo, FL, USA, Jun 7, 2022.
- "Simulation, prediction, and attribution study for tropical cyclones using GFDL HiFLOR Model.," in *Seminar at BCCR/GFI*, University of Bergen, Bergen, Norway, Dec 10, 2019.

- "Seasonal Predictions of Tropical Cyclones in 2018 using GFDL, NICAM, and MRI High-Resolution Global Models," in *Japan Geoscience Union Meeting 2019*, Makuhari Messe Chiba, Chiba, Japan, May 26–30 2019.
- "A New Paradigm for Attribution Study for Extreme Tropical Cyclo0ne Season Using Seasonal Prediction System.," in *4th International Symposium on Climate and Earth System Modeling*, Qinglongshanzhuang Hotel, Nanjing, China, Jul 10–11 2018.
- "Dominant Role of Tropical Atlantic Warming on the Active 2017 Major Hurricanes over the North Atlantic," in *Japan Geoscience Union Meeting 2018*, Makuhari Messe Chiba, Chiba, Japan, May 20–24 2018.
- "Seasonal Prediction of Tropical Cyclone," in *GFDL Science Symposium*, Frick Chemistry Bldg., Princeton University, Princeton, USA, Nov 2 2017.
- "Seasonal forecasts of Category 4 and 5 hurricanes and landfalling tropical cyclones using a high resolution GFDL coupled climate model," in *Tropical Cyclone Risk Modeling Workshop*, Columbia University, Faculty House, May 9 2016.
- "Projections and predictions of tropical cyclones using the high-resolution GFDL FLOR coupled model" in *China-Korea Joint Climate Dynamics Workshop*, Daji, Nanjing, China, Dec 21–22 2015.
- "Investigating the Influence of Anthropogenic Forcing and Natural Variability on the 2014 Hawaiian Hurricane Season," in *seminar at University of Tsukuba*, University of Tsukuba, Tsukuba, Japan, October 14, 2015.
- "Projections and predictions of tropical cyclones using the high-resolution GFDL FLOR coupled model" in *annual conference in Japan Meteorological Society*, Tsukuba, Japan, May 21–24 2015.
- "Where will typhoons occur more or less in the future?" in *2013 APEC typhoon symposium*, NTU GIS Convention Center, Taipei, Taiwan, Oct 21–23 2013.
- "Uncertainties in future changes in tropical cyclone activity projected by multi-physics and multi-SST ensemble experiments" in *U.S. CLIVAR Hurricane Workshop*, Geophysical Fluid Dynamics Laboratory, Princeton, NJ, USA, 5–7 May 2013
- "Projected future increase in tropical cyclones near Hawaii". *The next-generation of climate models and knowledge discoveries through the extreme high-performance simulations and big data*, Lawrence Berkeley National Laboratory, CA, USA, 20–22 Mar 2013.
- "Projected future changes in tropical cyclones and their uncertainties by MRI-AGCMs" in *5th International Workshop on KAKUSHIN Program*. The Westin Maui Resort & Spa, Hawaii, USA, 12–15 March 2012
- "Future changes in tropical cyclone activity in the Indian Ocean projected by the new high-resolution MRI-AGCM" in *Second WMO International Conference on Indian Ocean Tropical Cyclones and Climate Change*, 14–17 Feb 2012, New Delhi, India.
- "Future changes in tropical cyclone activity projected by the new 20-km-mesh high-resolution MRI-AGCM" in *The 5th Korea-Japan-China joint conference on meteorology*, 24–26 Oct 2011, Bexco, Busan, Korea.
- "Tropical cyclone climate projections by a 20-km-mesh high-resolution MRI/JMA global atmospheric model" in *Seminar at Central Weather Bureau in Taiwan*, 15 Aug 2011, CWB, Taipei, Taiwan.
- "Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model" in East-Asia Conference, 6–7 Aug 2011, Hotel Kingdom, Kaohsiung, Taipei, Taiwan.

CONFERENCE PRESENTATION

- "Substantial global influence of anthropogenic aerosols on tropical cyclones over the last 40 years" in *Japan Geoscience Union Meeting 2022*, Makuhari Messe Chiba, Chiba, Japan, May 14 2022, oral.
- "Detected climate change in global tropical cyclone frequency of occurrence.," in *The 34th Conference on Hurricanes and Tropical Meteorology*, Virtual Conference, May 10-14 2021, oral.
- Increasing frequency of extreme precipitation in Japan due to global warming detected by a machine learning technique.," in *AGU Fall Meeting 2020*, Virtual Conference, Dec 1-17 2020.
- "Detected climate change in global distribution of tropical cyclones.," in Japan Geoscience Union Meeting 2019, Makuhari Messe Chiba, Chiba, Japan, May 24-28, 2020, oral.
- "Attribution of the extremely active 2018 typhoon season in the North Pacific.," in *IUGG*, Palais des Congres, Montreal, Quebec, Canada, Jul 8-18, 2019, (Oral).
- "Seasonal Predictions of Tropical Cyclones in 2018 using GFDL and NICAM High-Resolution Global Models," in *EGU General Assembly*, Austria Center Vienna, Vienna, Austria, April 7–12 2019, (Oral).
- "Dominant Effect of Relative Tropical Atlantic Warming on Major Hurricane Occurrence in the North Atlantic: 2017 and Future.," in *The American Meteorological Society 99th Annual Meeting*, Phoenix Convention Center, Phoenix, AZ, USA, Jan 6–9 2019, (Oral).
- "Real-time Seasonal Prediction of Tropical Cyclones in 2018 using GFDL High-Resolution Global Coupled Model," in *2018 AGU Fall Meeting*, Walter E. Washington Convention Center, Washington, D.C., USA, Dec 10–14 2018, (Oral).
- "Dominant Effect of Relative Tropical Atlantic Warming on Major Hurricane Occurrence in the North Atlantic: 2017 and the future," in *International Conferences on Subseasonal to Decadal Prediction*, NCAR, Boulder, CO, USA, Sep 17–21 2018, (Poster).
- "Attribution Study for Extreme Tropical Cyclone Seasons Using a High-Resolution Global Coupled Model – 2017 Active Major Hurricane Season -," in *AOGS*, Convention Center, Honolulu, Hi, USA, Jun 3–8 2018, (Oral).
- "Seasonal predictions for 2017 Hurricane Season," in *The Casualty Actuarial Society Sprint Meeting*, Marriot Copley Place, Boston, MA, USA, May 13–16 2018, (Oral).
- "Increasing frequency of extremely severe cyclonic storms over the Arabian Sea.," in *The 33rd Conference on Hurricanes and Tropical Meteorology*, Sawgrass Marriot Resort, Ponte Vedra Beach, FL, USA, Apr 16-18 2018, (Oral).
- "Real-time Seasonal Prediction of Major Hurricanes in 2017 using High-Resolution Global Coupled Model (HiFLOR)," in *GFDL Poster Expo*, GFDL, Princeton, NJ, USA, Jan 31 2018, (Poster).
- "Real-time Seasonal Prediction of Major Hurricane in 2017 using High-Resolution Global Coupled Model," in *2017 AGU Fall Meeting*, Convention Center, New Orleans, LU, USA, Dec 12, 2017, (Poster).
- "Seasonal Forecasts of Major Hurricanes and Landfalling Tropical Cyclones using a High-Resolution GFDL Coupled Climate Model," in *2017 AGU Fall Meeting*, Convention Center, New Orleans, LU, USA, Dec 11, 2017, (Oral).
- "Dominant role of subtropical Pacific warming on the extreme 2015 eastern Pacific hurricane season," in *NUIST Seminar*, Nanjing University of Information Science & Technology, Nanjing, China, Jun 16, 2017, (Oral).

- "Dominant role of subtropical Pacific warming on the extreme 2015 eastern Pacific hurricane season," in *6th International Summit on Hurricanes and Climate Change: From Hazard to Impact*, Aldemar Knossos Royal Village Conference Center, Heraklion, Crete, Greece, Jun 4–9 2017, (Poster).
- "Simulation, Prediction and Attribution Study for Tropical Cyclones using GFDL HiFLOR," in *GFDL Seminar*, Geophysical Fluid Dynamics Laboratory, Princeton, NJ, USA, Mar 8 2017, (Oral).
- "Dominant role of subtropical Pacific warming on the extreme 2015 eastern Pacific hurricane season," in *AOGS*, China National Convention Centre, Beijing, China, Jul 31-Aug 5, 2016, (Oral).
- "Dominant role of subtropical Pacific warming on the extreme 2015 eastern Pacific hurricane season," in *GFDL Seminar*, Geophysical Fluid Dynamics Laboratory, Princeton, NJ, USA, May 25, 2016, (Oral).
- "Simulation and prediction of category 4 and 5 hurricanes in the high-resolution GFDL HiFLOR coupled climate model.," in *The 32nd Conference on Hurricanes and Tropical Meteorology*, The Condado Hilton Plaza, San Juan, Puerto Rico, Apr 17-22 2016, (Oral).
- "Dominant role of subtropical Pacific warming on the extreme 2015 Central Pacific hurricane season.," in *The 32nd Conference on Hurricanes and Tropical Meteorology*, The Condado Hilton Plaza, San Juan, Puerto Rico, Apr 17-22 2016, (Poster).
- "Investigating the Influence of Anthropogenic Forcing and Natural Variability on the 2014 Hawaiian Hurricane Season," in *40th Annual Climate Diagnostics and Prediction Workshop*, Magnolia Hotel, Denver, CO, USA, October 26–29 2015, (Oral).
- "Investigating the Influence of Anthropogenic Forcing and Natural Variability on the 2014 Hawaiian Hurricane Season," in *Northeast Tropical Workshop*, MIT Endicott House, Dedham, MA, USA, June 9–12 2015, (Oral).
- "Projected increase in tropical cyclones near Hawaii.," in *Tropical weather and climate dynamics workshop*, Pagoda hotel, Honolulu, Hawaii, USA, Oct 9–12 2013, (Oral).
- "Future changes in tropical cyclone activity with the new high-resolution MRI-AGCM" in *The 30th Conference on Hurricanes and Tropical Meteorology*, 15–20 April 2012, the Marriott Sawgrass in Ponte Vedra Beach, Florida, Ponte Vedra Beach, FL, USA (Oral).
- "Uncertainties in future changes in tropical cyclone activity projected by multi-physics and multi-SST ensemble experiments using the 60-km-mesh MRI-AGCM" in *The 30th Conference on Hurricanes and Tropical Meteorology*, 15–20 April 2012, the Marriott Sawgrass in Ponte Vedra Beach, Florida, Ponte Vedra Beach, FL, USA (Poster).
- "Future changes in tropical cyclone activity projected by multi-physics and multi-SST ensemble experiments using the 60-km-mesh MRI-AGCM" in *Seminar at APCC*, 27 Oct 2011, APCC, Busan, Korea (Oral).
- "Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model" in *AOGS*, 8–12 Aug 2011, Taipei International Convention Center, Taipei, Taiwan (Oral).

- "Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model" in *IUGG*, 28 Jun 2011, Melbourne Convention and Exhibition Center, Melbourne, VIC, AUS (Oral).
- "Hawaii climate change in the T959 MRI global simulation. The Science of Climate Change" in *Hawai'I Symposium*, 9–20 Jan 2011, East-West Center, Honolulu, HI, US (Oral).
- "Future change of western North Pacific typhoons: Projections by a 20-km-mesh global atmospheric model" in *AGU fall meeting*, 13–17 Dec 2010, Moscone Convention Center, San Francisco, CA, USA (Poster).
- "Future change of North Atlantic tropical cyclone tracks: projection by a 20-km-mesh global climate model" in *The 29th Conference on Hurricanes and Tropical Meteorology*, 10–14 May 2010, JW Marriott Starr Pass Resort and Spa, Tucson, AZ, USA (Poster).
- "Future change of North Atlantic tropical-cyclone tracks: projection by a 20-km-mesh global climate model" in *Fourth Japan-China-Korea Joint Conference on Meteorology*, Tsukuba, Ibaraki, Japan (Oral).
- "Future change in tropical-cyclone tracks as simulated with a 20-km-mesh atmospheric global circulation model. -–North Atlantic—" in *Workshop on High-Resolution Climate Modeling*, 10–14 August 2009, International Center for Theoretical Physics, Kastler Lecture Hall, Trieste, Italy (Poster).
- "Impact of global warming on tropical cyclone structure change with a 20km-mesh high-resolution global model" in *American Meteorological Society 89th Annual Meeting*, Phoenix, AZ, USA (Oral)
- "Simulations of present-day tropical cyclone climatology and their temporal variability associated with ENSO with a 20-km-mesh high-resolution AGCM" in *The American Meteorological Society 89th Annual Meeting*, Phoenix, AZ, USA, (Poster).
- "Typhoon simulation with the JMA/MRI 20km-mesh high-resolution global spectral model" in *The 28th Conference on Hurricanes and Tropical Meteorology*, April 28–May 2, 2008, Wyndham Orlando Resort, Orlando, FL, USA (Oral).
- "Typhoon simulation with the 20 km mesh global spectral model on the Earth Simulator" in *The 2nd International Workshop on the "Kyosei" Project and the 7th International Workshop on Next Generation Climate Models for Advanced High Performance Computing Facilities*, Hawaii, USA, 24–26 February 2005 (Oral).

CAMPUS OR DEPARTMENTAL TALKS

- "Detected climate change in global tropical cyclone frequency of occurrence.," in *Seminar at SoMAS*, Stony Brook University , NY, USA, Sep 7, 2022, oral, invited.
- "On the mechanisms of the active 2018 tropical cyclone season in the North Pacific.," in *NUIST Seminar*, Nanjing University of Information Science & Technology, Nanjing, China, Jan 15 2020.

- "Simulation, prediction, and attribution study for tropical cyclones using GFDL HiFLOR Model.," in *Seminar at BCCR/GFI*, University of Bergen, Bergen, Norway, Dec 10, 2019
- "Prediction, Projection, and Attribution Study for Tropical Cyclones Using GFDL Global Climate Model.," in *Seminar at Stevens Institute and Technology*, Stevens Institute and Technology, Hoboken, NJ, USA, Mar 5, 2019.
- "Prediction, Projection, and Attribution Study for Tropical Cyclones using the High-Resolution GFDL HiFLOR Coupled Climate Model," in *Seminar at Lamont-Doherty Earth Observatory of Columbia University*, Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, USA, Nov 30, 2018.

TEACHING EXPERIENCE

Meteorological Research Institute

Introduction of tropical cyclone climate (2011)

Lecturer

Princeton University Atmospheric & Oceanic Science Workshop on Attribution of Extreme Events to Climate Change (2022)

RESEARCH EXPERIENCE

- Deep learning for extreme precipitation events.
- Conducting future projections of tropical cyclone activity.
- Seasonal to decadal prediction of tropical cyclones.
- Developing numerical dynamical model.
- Risk assessment for tropical cyclones using a Geographic Information System (GIS).
- Collaborating with experts in civil engendering for assessing the impact of tropical cyclones on flooding.
- Fieldwork to mitigate urban heatwaves.

SERVICE TO PROFESSION

Manuscript Reviews

- Nature: 1(2014), 1(2020), 1(2021)
- Science: 1(2018)
- Nature Climate Change: 1(2014)
- Proceedings of the National Academy of Sciences: 1(2019), 1(2020)
- Science Advances: 1(2017), 1(2022)
- Bulletin of the American Meteorological Society: 1(2015), 1(2017), 1(2019)
- Journal of Climate: 1(2011), 3(2012), 1(2013), 4(2014), 6(2015), 4(2016), 3(2017), 1(2018), 1(2019), 3(2020), 1(2021), 1(2022)
- Monthly Weather Review: 1(2015), 1(2018)
- Climate Dynamics: 1(2009), 1(2012), 1(2016), 2(2017), 1(2020)
- Journal of Geophysical Research-Atmosphere: 1(2012), 2(2015)

- Journal of Geophysical Research-Oceans: 1(2011), 1(2013)
- Journal of Advances in Modeling Earth Systems: 1(2017)
- Geophysical Research Letters: 1(2012), 1(2013), 1(2014), 2(2018), 2(2019), 2(2020), 1(2021), 2(2022)
- Journal of Meteorological Society of Japan: 1(2007), 1(2011), 1(2012), 1(2016), 1(2018), 2(2019)
- Npj Climate and Atmospheric Science: 1(2018), 1(2022)
- International Journal of Climatology: 1(2018), 1(2019)
- Asian Pacific Journal of Atmospheric Science: 1(2010), 1(2022)
- Tellus A: 1 (2011)
- Climatic Change: 1(2017)
- Dynamics of Atmospheres and Oceans: 1(2017)
- Meteorology and Atmospheric Physics: 1 (2011)
- Scientific Online Letters on the Atmosphere: 1(2013), 1(2015), 1(2018)
- Journal of Meteorological Research: 1(2022)
- GFDL internal reviews: 5(2014), 4(2015), 3(2016), 2(2017), 2(2018), 3(2019), 4(2020), 5(2021), 3(2022)

Grant Review
- NOAA MAPP Panel Review: 1(2018)

Editor
Editorial Board: *MDPI Oceans*, Jul 2019–Now
Editorial Board: *MDPI Atmosphere*, Jul 2019– Now
Editor: *Advances in Atmospheric Sciences*, Jan 2020–Now
Editor*: Scientific Online Letters on the Atmosphere (SOLA)*, Jan 2020–Now

Leadership
- Leading Real-time Seasonal Hurricane Predictions at GFDL
- Leading the NOAA-JAMSTEC Research Collaboration for hurricane predictions and projections

SUPERVISING

Shuai Wang (Princeton University, Associate Research Scholar, Jan 2022–Present)
Gan Zhang (Princeton University, Postdoc Fellow, Mar 2018–Aug 2020)
Dasol Kim (Seoul University, Exchange student, Aug 2018–Jan 2019)
Yitian Qian (Nanjing University of Information Science and Technology, Exchange student, Nov 2018–Oct 2019)
Emma Levin (Paul D. Schreiber High School, Intern student, Mar 2018–May 2019)

SELECTED MEDIA COVERAGE

[1] 2022: PBS Terra, "How Hurricane History Has Hidden What's Coming"

[2] 2022: CNN, "Hurricane numbers are decreasing in every ocean basin except for one, study finds"

[3] 2022: NBC24, "How air pollution impacts hurricanes

[4] 2022: The Wall Street Journal, "Hurricane Zone Predicted to Expand, Raising Threat to Major Cities"

[5] 2022: NHK News, "Aerosols impacts tropical cyclones"

[6] 2022: AccuWeather, "New study links decreasing air pollution to increasing hurricanes"

[7] 2022: New York Times, "Air pollution can mean more or fewer hurricanes. It depends on where you live"

[8] 2022: AP, "Study finds cleaner air leads to more Atlantic hurricanes"

[9] 2022: CNN, "Reducing harmful air pollution has led to a surprising effect − more hurricanes in the North Atlantic"

[10] 2022: NHK News, "Increasing anomalous precipitation events in Japan"

[11] 2022: Washington Post: "Study finds cleaner air leads to more Atlantic hurricanes"

[12] 2020: NOAA Research Highlight, "Study: Climate change has been influencing where tropical cyclones rage"

[13] 2018: The Washington Post, "Study: Warming ocean waters intensified devastating 2017 Atlantic hurricane season"

[14] 2018: Newsweek, "Humans May Have Been Partly Responsible for 2017's Catastrophic Hurricane Season"

[15] 2018: NHK (Japanese National TV Program), "Study: Climate change drove intense hurricanes"

[16] 2018: The Associated Press, "Science Says: Hawaii hurricanes rare, but getting less so"

[17] 2017: New Scientist, "Climate change blamed for Arabian Sea's unexpected hurricanes"

[18] 2017: Princeton PEI News, "Birth of a storm in the Arabian Sea validates climate model"

[19] 2016: The New York Times, "Hurricane Season Is Heading Up. So Is the Planet. Coincidence?"

[20] 2015: Climate Central, "Hawaii May Say 'Aloha' to More Hurricanes"

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