Ming Zhao
Senior Physical Scientist[1]
Deputy Division Leader, [Atmospheric Physics Division]
[Geophysical Fluid Dynamics Laboratory / NOAA]
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Education

- Ph.D., Atmospheric Science, University of British Columbia, 2003
- M.S., Meteorology, Nanjing Institute of Meteorology, 1993
- B.S., Meteorology, Nanjing Institute of Meteorology, 1990

Research Interests

- Global atmospheric model development with an emphasis on the representation of atmospheric convection, clouds, and boundary layer turbulence
- Tropical cyclones and climate connections
- High-impact weather and extremes under present-day and changing environmental conditions
- Convection, clouds, and cloud feedbacks on the large-scale environment
- Studies of atmospheric convection, clouds, and climate using model hierarchies with varying levels of complexity
- Earth system science and modeling with an emphasis on process interactions, including ocean-atmosphere coupling, aerosols-cloud-radiation-circulation interactions, and land-surface-vegetation-hydrology-atmosphere interactions

Employment

- Senior Physical Scientist, GFDL/NOAA, Princeton, New Jersey, USA, 03/2022-present
- Physical Scientist, GFDL/NOAA, Princeton, New Jersey, USA, 11/2016-03/2022
- Project Scientist III, UCAR, GFDL/NOAA, Princeton, NJ, USA, 2013-2016
- Project Scientist II, UCAR, GFDL/NOAA, Princeton, NJ, USA, 2007-2013
- Associate Research Scholar, Princeton University, GFDL/NOAA, Princeton, NJ, USA, 2006-2007
- Research Associate, Princeton University, GFDL/NOAA, Princeton, NJ, USA, 2004-2006
- Post-doctoral Fellow, Canadian Centre for Climate Modelling and Analysis (CCCma), Victoria, University of Victoria, Canada, 2003-2004
- Meteorologist & Head (1995-1998) of Nowcasting branch, Shanghai Meteorological Center, Shanghai, China, 1993-1998

Professional Experience and Responsibilities

- Member of US CLIVAR Process Study and Model Improvement Panel (2022-present)
- Member of American Meteorological Society (AMS) Committee on Tropical Meteorology and Tropical Cyclones (2018-2023)
- Co-lead of NOAA Climate Program Office (CPO) Modeling, Analysis, Predictions, and Projections (MAPP) Program (MAPP) Climate Sensitivity Task Force (2020-2023)
- Member of NOAA CPO MAPP Model Diagnostics Task Force (2015-present)
- Member of writing team for NOAA's Precipitation Grand Challenge Strategic Plan (2020)
- Member of NCEP Unified Modeling Strategic Implementation Plan Working Group on Physics (2017)

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[1] Senior Scientist positions at GFDL are considered equivalent to full professor positions at major U.S. research universities, based on appointment criteria. The evaluation process requires five reference letters that explicitly assess whether the candidate's accomplishments are comparable to those of a full professor at a leading U.S. university.

- Member of NOAA CPO MAPP Climate Model Development Task Force (2014-2017)
- Member of NOAA CPO MAPP Climate Prediction Task Force (2012-2015)
- Member of NOAA CPO MAPP CMIP5 Task Force (2011-2014)
- Core member of the U.S. CLIVAR Hurricane Working Group (2011-2014)
- Member of GFDL Research Council (2018-Present)
- Member of GFDL Outstanding Paper nomination committee (2020)
- Co-lead (2013-2015) and lead (2015-2018) of GFDL Model Development Team (MDT) Atmospheric Working Group (AWG) for developing GFDL new generation global atmospheric model AM4 (2013-2018)
- Co-lead of GFDL Model Development Team (MDT) Coupled Working Group (CWG) for developing GFDL new generation coupled physical climate model CM4 (2013-2019)
- Co-lead of GFDL Cloud and Climate Initiative (2013-present)
- Lead developer for GFDL Global High Resolution Atmospheric Model (HiRAM) (2007-2011)
- Core developer for GFDL Global Atmospheric Model version 3 (AM3) (2007-2011)
- Served as Lead PI, PI, and co-PI on numerous successfully funded research proposals
- Advisor and co-advisor to ten postdoctoral researchers at Princeton University and GFDL/NOAA
- Invited speaker at universities (e.g., Columbia University, the University of Michigan, and Stony Brook University), at AGU and other conferences, and at international workshops
- Member of four PhD committees at the Atmospheric & Ocean Sciences (AOS) Program at Princeton University
- Session organizer and co-chair, 35th AMS Conference on Hurricanes and Tropical Meteorology, New Orleans, USA, May 9 - 13, 2022
- Session co-convenor and co-chair, CMIP6 Climate Model Evaluation, 2021 AGU Fall meeting
- Session co-convenor and co-chair, CMIP6 Climate Model Evaluation, 2020 AGU Fall meeting
- Session co-convenor and co-chair, CMIP6 Climate Model Evaluation, 2019 AGU Fall meeting
- Session chair, Climate Change I & II, 33rd AMS Conference on Hurricanes and Tropical Meteorology, April 16 - 20, 2018 Ponte Vedra, Florida, 2018
- Session chair, Climate III, 31st American Meteorological Society (AMS) Conference on Hurricanes and Tropical Meteorology, San Diego, USA, March 30 - April 04, 2014
- Session chair, Precipitation in a Changing Climate, Joint CFMIP (Cloud Feedback Model Intercomparison Project) / EUCLIPSE (European Union CLoud Inter-comparison, Process Study & Evaluation project) Meeting on Cloud Processes and Climate Feedbacks, Hamburg, Germany, June 10-14, 2013
- Review panelist for NASA and DOE Grant Proposal
- Reviewer for National Science Foundation Grant Proposal, NOAA Climate Program Office Funding Proposal
- Reviewer for *Nature Climate Change, Nature Communications, Bulletin of the American Meteorological Society, Journal of Climate, Journal of Atmospheric Sciences, Journal of Geophysical Research, Geophysical Research Letters, Journal of Advances in Modeling Earth Systems, Climate Dynamics, Climate Change, Quarterly Journal of the Royal Meteorological Society, Journal of the Meteorological Society of Japan, Dynamics of Atmospheres and Oceans, International Journal of Climatology, Advances in Atmospheric Sciences*
- Member of American Geophysical Union
- Member of European Geophysical Union
- Member of American Meteorological Society

Awards and Recognitions

- American Geophysical Union's (AGU) 2022 Atmospheric Sciences Ascent Award for growing research accomplishments and leadership in climate model development

- 2022 NOAA OAR Employee Of the Year Award for exemplary scientific leadership in the development and utilization of high-resolution climate models for studying extreme weather and extreme precipitation under climate change
- 2022 NOAA Administrator's Award for advancing the understanding of the Earth System by developing and applying NOAA's state-of-the-art Coupled Carbon-Chemistry-Climate model
- Ranked #618 among the Reuters hot 1000 list of the world's top climate scientists in 2020.
- Recipient of 2018 NOAA OAR Outstanding Scientific Paper Award (Climate category) (This award recognizes the preeminent science that OAR employees and affiliates publish through rigorous peer review processes. Awards are under three categories corresponding to NOAA's mission goals in Climate, Oceans and Great Lakes, and Weather. There was one paper awarded under each category in December 2018)
- Consistently ranked in the highest performance category and achieved the top retention score in annual performance reviews each year since joining NOAA
- University Graduate Fellowship, University of British Columbia, Canada, 1998–2001
- Lee Scholarship, University of British Columbia, Canada, 1998
- Second Place Award for Scientific and Technological Development, China Meteorological Administration, 1996
- First Place Award for Scientific and Technological Development, National Meteorological Center of China, 1996
- Outstanding Paper Award, Shanghai Meteorological Center, China, 1994 and 1995

Total Refereed Publications:
158 publications; H-index: 56; total citations: 11677; citing articles: 7961 (based on Web of Science Core collection data, as of June, 2025)

- **ResearchID**: **https://www.webofscience.com/wos/author/record/C-6928-2014**
- **Google Scholar**: **https://scholar.google.com/citations?user=Fs21qjcAAAAJ&hl=en**
- **ORCID**: **https://orcid.org/0000-0003-4996-7821**
- **GFDL bibliography**: **https://www.gfdl.noaa.gov/bibliography/results.php?author=1158**

Selected Publications Organized by Research Area:

(The following citation counts are based on the Web of Science Core Collection and Google Scholar, as of April, 2025. 🏆 indicates a Web of Science Highly Cited Paper, recognized for receiving enough citations to rank in the top 1% of the academic field of Geosciences, based on the citation threshold for the field and publication year.)

Selected publications on global atmospheric, climate and Earth system model development

1) **Zhao, Ming**, I. M. Held, S-J Lin, and G. A. Vecchi, 2009: Simulations of global hurricane climatology, inter-annual variability, and response to global warming using a 50km resolution GCM. *Journal of Climate*, 22(24), DOI: 10.1175/2009JCLI3049.1. **(Citation: 555 times Web of Science; 791 times Google Scholar; This is the GFDL HiRAM model documentation paper.)**
2) **Zhao, Ming**, J-C Golaz, I. M. Held, and 42 co-authors, 2018a: The GFDL Global Atmosphere and Land Model AM4.0/LM4.0 - Part I: Simulation Characteristics with Prescribed SSTs. *Journal of Advances in Modeling Earth Systems*. DOI:10.1002/2017MS001208. **(Citation: 219 times Web of Science🏆; 290 times Google Scholar)**
3) **Zhao, Ming**, J-C Golaz, I. M. Held, and 42 co-authors, 2018b: The GFDL Global Atmosphere and Land Model AM4.0/LM4.0 - Part II: Model Description, Sensitivity Studies, and Tuning Strategies.

Journal of Advances in Modeling Earth Systems. DOI:10.1002/2017MS001209. **(Citation: 242 times Web of Science🏆; 307 times Google Scholar)**

4) Held, I. M., and co-authors including **Ming Zhao**, 2019: Structure and Performance of GFDL's CM4.0 Climate Model. *Journal of Advances in Modeling Earth Systems*, 11(11), DOI:10.1029/2019MS001829 **(Citation: 336 times Web of Science🏆; 449 times Google Scholar)**
5) Dunne, J. P., and co-authors including **Ming Zhao** 2020: The GFDL Earth System Model version 4.1 (GFDL-ESM 4.1): Overall coupled model description and simulation characteristics. *Journal of Advances in Modeling Earth Systems*, 12(11), DOI:10.1029/2019MS002015. **(Citation: 492 times Web of Science🏆; 707 times Google Scholar)**
6) Delworth, T. L., and co-authors including **Ming Zhao**, 2020: SPEAR – the next generation GFDL modeling system for seasonal to multidecadal prediction and projection. *Journal of Advances in Modeling Earth Systems*, 12(3), DOI:10.1029/2019MS001895. **(Citation: 164 times Web of Science🏆; 202 times Google Scholar)**
7) Horowitz, L. W., and co-authors including **Ming Zhao**, 2020: The GFDL Global Atmospheric Chemistry-Climate Model AM4.1: Model Description and Simulation Characteristics. *Journal of Advances in Modeling Earth Systems*, 12(10), DOI:10.1029/2019MS002032. **(Citation: 74 times Web of Science; 111 times Google Scholar)**
8) Donner, Leo J., and co-authors including **Ming Zhao**, 2011: The dynamical core, physical parameterizations, and basic simulation characteristics of the atmospheric component AM3 of the GFDL Global Coupled Model CM3. *Journal of Climate*, 24(13), DOI:10.1175/2011JCLI3955.1. **(Citation: 835 times Web of Science; 1142 times Google Scholar)**
9) Lin, M, LW Horowitz, **Ming Zhao**, L Harris, P Ginoux, JP Dunne, S Malyshev, E Shevliakova, H Ahsan, ST Garner, F Paulot, A Pouyaei, SJ Smith, Y Xie, N Zadeh, and L Zhou, 2024: The GFDL variable-resolution global chemistry-climate model for research at the nexus of US climate and air quality extremes. *Journal of Advances in Modeling Earth Systems*, 16(4), DOI:10.1029/2023MS003984. **(Citation: 7 times Web of Science; 7 times Google Scholar)**
10) Guo, H, Y Ming, S Fan, L Zhou, L Harris, and **Ming Zhao**, 2021: Two-moment bulk cloud microphysics with prognostic precipitation in GFDL's Atmosphere Model AM4.0: configuration and performance. *Journal of Advances in Modeling Earth Systems*, 13(6), DOI:10.1029/2020MS002453. **(Citation: 14 times Web of Science; 21 times Google Scholar)**
11) Chu, W, Y. Lin, and **Ming Zhao**, 2021: Implementation and evaluation of a double-plume convective parameterization in NCAR CAM5, DOI: https://doi.org/10.1175/JCLI-D-21-0267.1 **(Citation: 6 times Web of Science; 10 times Google Scholar)**

Selected publications on tropical cyclones and climate connections

1) **Zhao, Ming**, I. M. Held, and S-J Lin, 2012: Some counter-intuitive dependencies of tropical cyclone frequency on parameters in a GCM. *Journal of the Atmospheric Sciences*, 69(7), DOI: 10.1175/JAS-D-11-0238.1. **(Citation: 109 times Web of Science; 149 times Google Scholar)**
2) **Zhao, Ming**, and I. M. Held, 2012: TC-permitting GCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. *Journal of Climate*, 25(8), DOI: 10.1175/JCLI-D-11-00313.1. **(Citation: 102 times Web of Science; 140 times Google Scholar)**
3) **Zhao, Ming**, I. M. Held, and G. A. Vecchi, 2010: Retrospective forecasts of the hurricane season using a global atmospheric model assuming persistence of SST anomalies. *Monthly Weather*

Review, 138(10), DOI:10.1175/2010MWR3366.1. **(Citation: 82 times Web of Science; 125 times Google Scholar)**

4) **Zhao, Ming**, and I. M. Held, 2010: An analysis of the effect of global warming on the intensity of Atlantic hurricanes using a GCM with statistical refinement. *Journal of Climate*, 23(23), DOI: 10.1175/2010JCLI3837.1. **(Citation: 71 times Web of Science; 100 times Google Scholar)**
5) **Zhao, Ming**, I. M. Held, S-J Lin, and G. A. Vecchi, 2009: Simulations of global hurricane climatology, inter-annual variability, and response to global warming using a 50km resolution GCM. *Journal of Climate*, 22(24), DOI: 10.1175/2009JCLI3049.1. **(Citation: 555 times Web of Science; 791 times Google Scholar)**
6) Held, I. M. and **Ming Zhao**, 2011: The response of tropical cyclone statistics to an increase in CO2 with fixed sea surface temperatures. *Journal of Climate*, 24(20), DOI:10.1175/JCLI-D-11-00050.1. **(Citation: 110 times Web of Science; 164 times Google Scholar)**
7) Lin, Y., **Ming Zhao**, and M. Zhang, 2015: Tropical cyclone rainfall area controlled by relative sea surface temperature. *Nature Communications,* 6, 6591, DOI:10.1038/ncomms7591. **(Citation:179 times Web of Science; 202 times Google Scholar)**
8) Murakami, H., T. L. Delworth, W. F. Cooke, **Ming Zhao**, B. Xiang, and P-C Hsu, 2020: Detected climatic change in global distribution of tropical cyclones. *Proceedings of the National Academy of Sciences,* 117(20), DOI:10.1073/pnas.1922500117. **(Citation: 167 times Web of Science🏆, 242 times Google Scholar)**
9) Walsh, Kevin J., and co-authors including **Ming Zhao**, 2015: Hurricanes and climate: the U.S. CLIVAR working group on hurricanes. *Bulletin of the American Meteorological Society*, 96(6), DOI:10.1175/BAMS-D-13-00242.1. **(Citation: 159 times Web of Science; 219 times Google Scholar)**
10) Vecchi, G. A., **Ming Zhao**, H. Wang, G. Villarini, A. Rosati, A. Kumar, I. M. Held, and R. G. Gudgel, 2011: Statistical-dynamical predictions of seasonal North Atlantic hurricane activity. *Monthly Weather Review*, 139(4), DOI:10.1175/2010MWR3499.1. **(Citation: 128 times Web of Science; 176 times Google Scholar)**
11) Knutson, T. R., J. J. Sirutis, **Ming Zhao**, R. E. Tuleya, M. A. Bender, G. A. Vecchi, G. Villarini, and D. Chavas, 2015: Global Projections of Intense Tropical Cyclone Activity for the Late Twenty-First Century from Dynamical Downscaling of CMIP5/RCP4.5 Scenarios. *Journal of Climate*, 28(18), DOI:10.1175/JCLI-D-15-0129.1. **(Citation: 380 times Web of Science🏆; 623 times Google Scholar)**
12) Knutson, T. R., J. J. Sirutis, G. A. Vecchi, S. T. Garner, **Ming Zhao**, H-S Kim, M. A. Bender, R. E Tuleya, I. M. Held, and G. Villarini, 2013: Dynamical downscaling projections of 21st century Atlantic hurricane activity: CMIP3 and CMIP5 model-based scenario. *Journal of Climate*, 26(17), DOI:10.1175/JCLI-D-12-00539.1. **(Citation:295 times Web of Science; 458 times Google Scholar)**
13) Li, T., M. Kwon, and **Ming Zhao**, 2010: Global warming shifts Pacific tropical cyclone location. *Geophysical Research Letters*, 37, L21804, DOI:10.1029/2010GL045124. **(Citation: 90 times Web of Science; 132 times Google Scholar)**
14) Camargo, S. J., M. K. Tippett, A. Sobel, G. A. Vecchi, and **Ming Zhao**, 2014: Testing the performance of tropical cyclone genesis indices in future climates using the HIRAM model. *Journal of Climate*, 27(24), DOI:10.1175/JCLI-D-13-00505.1. **(Citation: 123 times Web of Science; 172 times Google Scholar)**

15) Villarini, G., D. A. Lavers, E. Scoccimarro, **Ming Zhao**, M. F. Wehner, G. A. Vecchi, T. R. Knutson, and K. A. Reed, 2014: Sensitivity of Tropical Cyclone Rainfall to Idealized Global Scale Forcings. *Journal of Climate*, 27(12), DOI:10.1175/JCLI-D-13-00780.1. **(Citation: 100 times Web of Science; 139 times Google Scholar)**
16) Shaevitz, D. and co-authors including **Ming Zhao**, 2014: Characteristics of tropical cyclones in high-resolution models in the present climate. *Journal of Advances in Modeling Earth Systems*, 6(4), DOI:10.1002/2014MS000372. **(Citation: 116 times Web of Science; 151 times Google Scholar)**
17) Kim, H.-S., G. A. Vecchi, T. R. Knutson, W. G. Anderson, T. L. Delworth, A. Rosati, F. Zeng, and **Ming Zhao**, 2014: Tropical Cyclone Simulation and Response to CO2 Doubling in the GFDL CM2.5 High-Resolution Coupled Climate Model. *Journal of Climate*, 27(21), DOI:10.1175/JCLI-D-13-00475.1. **(Citation: 133 times Web of Science; 167 times Google Scholar)**
18) Vecchi, G. A., S. Fueglistaler, I. M. Held, T. R. Knutson, and **Ming Zhao**, 2013: Impacts of atmospheric temperature trends on tropical cyclone activity. *Journal of Climate*, 26(11), DOI:10.1175/JCLI-D-12-00503.1. **(Citation: 74 times Web of Science; 117 times Google Scholar)**
19) Scoccimarro, E., S. Gualdi, G. Villarini, G. A. Vecchi, **Ming Zhao**, K. Walsh, and A. Navarra 2014: Intense Precipitation Events Associated with Landfalling Tropical Cyclones in response to a Warmer Climate and increased CO2. *Journal of Climate*, 27(12), DOI:10.1175/JCLI-D-14-00065.1. **(Citation: 80 times Web of Science; 113 times Google Scholar)**
20) Horn, M, K. Walsh, **Ming Zhao**, S. J. Camargo, E. Scoccimarro, H. Murakami, H. Wang, and A. Ballinger, A. Kumar, D. A. Shaevitz, J. A. Jonas, K. Oouchi 2014: Tracking Scheme Dependence of Simulated Tropical Cyclone Response to Idealized Climate Simulations. *Journal of Climate*, 27(24), DOI:10.1175/JCLI-D-14-00200.1. **(Citation: 91 times Web of Science; 123 times Google Scholar)**
21) Nakamura, J, S. J. Camargo, A. Sobel, N Henderson, K A Emanuel, A Kumar, T LaRow, H Murakami, M J Roberts, E Scoccimarro, P L Vidale, H Wang, M F Wehner, and **Ming Zhao**, 2017: Western North Pacific tropical cyclone model tracks in present and future climates. *Journal of Geophysical Research: Atmospheres*, 122(18), DOI:10.1002/2017JD027007. **(Citation: 61 times Web of Science; 87 times Google Scholar)**

Selected publications on clouds, cloud feedbacks, and climate sensitivity

1) **Zhao, Ming**, 2024: Cloud radiative effects associated with daily weather regimes. *Geophysical Research Letters*, 51(10), DOI:10.1029/2024GL109090.
2) **Zhao, Ming**, 2022: An investigation of the effective climate sensitivity in GFDL's new climate models CM4.0 and SPEAR. *J. Climate*. DOI: https://doi.org/10.1175/JCLI-D-21-0327.1 **(Citation: 4 times Web of Science; 7 times Google Scholar)**
3) **Zhao, Ming**, J-C Golaz, I. M. Held, V. Ramaswamy, S-J Lin, Y. Ming, P. Ginoux, B. Wyman, L. J. Donner, D. Paynter and H. Guo, 2016: Uncertainty in model climate sensitivity traced to representations of cumulus precipitation microphysics. *Journal of Climate*, 29, 543-560. DOI: 10.1175/JCLI-D-15-0191.1 **(Citation: 115 times Web of Science; 160 times Google Scholar, NOAA OAR Outstanding Paper Award)**
4) **Zhao, Ming**, 2014: An investigation of the connections among convection, clouds, and climate sensitivity in a global climate model. *Journal of Climate*, 27(5), DOI: 10.1175/JCLI-D-13-00145.1. **(Citation: 100 times Web of Science; 143 times Google Scholar)**

5) Zhang, B, **Ming Zhao**, and Z Tan, 2023: Using a Green's Function approach to diagnose the pattern effect in GFDL AM4 and CM4. Journal of Climate, 36(4), DOI:10.1175/JCLI-D-22-0024.11105–1124. **(Citation: 16 times Web of Science; 29 times Google Scholar)**
6) Zhang, B, **Ming Zhao**, H He, BJ Soden, Z Tan, B Xiang, and C Wang, 2023: The dependence of climate sensitivity on the meridional distribution of radiative forcing. Geophysical Research Letters, 50(18), DOI:10.1029/2023GL105492. **(Citation: 7 times Web of Science; 9 times Google Scholar)**
7) Bloch-Johnson, J, M Rugenstein, MJ Alessi, C Proistosescu, **Ming Zhao**, Bosong Zhang, Andrew I L Williams, Jonathan M Gregory, Jason N S Cole, Yue Dong, Margaret L Duffy, Sarah M Kang, and Chen Zhou, February 2024: The Green's Function Model Intercomparison Project (GFMIP) protocol. *Journal of Advances in Modeling Earth Systems*, 16(2), DOI:10.1029/2023MS003700. **(Citation: 13 times Web of Science; 34 times Google Scholar)**
8) Lutsko, N. J., S. C. Sherwood, and **Ming Zhao,** 2023: *Precipitation Efficiency and Climate Sensitivity*. In *Clouds and Climate Monograph*, *Geophysical Monograph Series on Clouds and Their Climatic Impacts: Radiation, Circulation, and Precipitation*. https://doi.org/10.1002/9781119700357.ch13 **(Citation: 3 times Web of Science; 3 times Google Scholar)**
9) Winton, M., A. Adcroft, J. P. Dunne, I. M. Held, E. Shevliakova, **Ming Zhao**, H. Guo, W. J. Hurlin, J. P. Krasting, T. R. Knutson, D. J. Paynter, L. G. Silvers, and R. Zhang, 2020: Climate Sensitivity of GFDL's CM4.0. *Journal of Advances in Modeling Earth Systems*, 12(1), DOI:10.1029/2019MS001838. **(Citation: 23 times Web of Science; 39 times Google Scholar)**
10) Paulot, F., D. J. Paynter, M. Winton, P. Ginoux, **Ming Zhao**, and L. W. Horowitz, 2020: Revisiting the impact of sea salt on climate sensitivity. *Geophysical Research Letters*, 47(3), DOI:10.1029/2019GL085601. **(Citation: 18 times Web of Science; 29 times Google Scholar)**
11) Naud, C M, J Jeyaratnam, J F Booth, **Ming Zhao**, and A Gettelman, 2020: Evaluation of modeled precipitation in oceanic extratropical cyclones using IMERG. *Journal of Climate*, 33(1), DOI:10.1175/JCLI-D-19-0369.1. **Citation: 16 times Web of Science; 19 times Google Scholar)**
12) Naud, C. M., J. F. Booth, J. Jeyaratnam, L. J. Donner, C. J. Seman, **Ming Zhao**, H. Guo, and Y. Ming, 2019: Extratropical Cyclone Clouds in the GFDL climate model: diagnosing biases and the associated causes. *Journal of Climate*, 32(20), DOI:10.1175/JCLI-D-19-0421.1. **(Citation: 11 times Web of Science; 14 times Google Scholar)**
13) Silvers, L. G., D. J. Paynter, and **Ming Zhao**, 2018: The Diversity of Cloud Responses to Twentieth Century Sea Surface Temperatures. *Geophysical Research Letters*, 45(1), DOI:10.1002/2017GL075583. **(Citation: 25 times Web of Science; 28 times Google Scholar)**
14) Xiang, B., **Ming Zhao**, I. M. Held, and J.-C. Golaz, 2017: Predicting the severity of spurious "double ITCZ" problem in CMIP5 coupled models from AMIP simulations. *Geophysical Research Letters*, 44(3), DOI:10.1002/2016GL071992. **(Citation: 65 times Web of Science; 91 times Google Scholar)**
15) Webb, M J., and co-authors including **Ming Zhao**, 2015: The impact of parametrized convection on cloud feedback. *Philosophical Transactions of the Royal Society of London, A*, 373, DOI:10.1098/rsta.2014.0414. **(Citation: 67 times Web of Science; 88 times Google Scholar)**
16) Zhang, M, and co-authors including **Ming Zhao**, 2013: CGILS: Results from the first phase of an international project to understand the physical mechanisms of low cloud feedbacks in single

column models. *Journal of Advances in Modeling Earth Systems*, 5(4), DOI:10.1002/2013MS000246. **(Citation: 122 times Web of Science; 155 times Google Scholar)**

17) Teixeira, J. and co-authors including **Ming Zhao**, 2011: Tropical and sub-tropical cloud transitions in weather and climate prediction models: the GCSS/WGNE Pacific Crosssection Intercomparison (GPCI). *Journal of Climate*, 24(20), DOI:10.1175/2011JCLI3672.1. **(Citation: 112 times Web of Science; 148 times Google Scholar)**
18) Golaz, J.-C., M. Salzmann, L. J. Donner, L. W. Horowitz, Y. Ming, and **Ming Zhao**, 2011: Sensitivity of the aerosol indirect effect to subgrid variability in the cloud parameterization of the GFDL Atmosphere General Circulation Model AM3. *Journal of Climate*, 24(13), DOI:10.1175/2010JCLI3945.1. **(Citation: 91 times Web of Science; 126 times Google Scholar)**
19) Wyant, M C., C S Bretherton, J T Bacmeister, J T Kiehl, I M Held, **Ming Zhao**, S A Klein, and B J Soden, 2006: A comparison of low-latitude cloud properties and their response to climate change in three AGCMs sorted into regimes using mid-tropospheric vertical velocity. *Climate Dynamics*, 27(2-3), DOI:10.1007/s00382-006-0138-4. **(Citation: 102 times Web of Science; 110 times Google Scholar)**
20) Xiang, Baoqiang, **Ming Zhao**, and Yi Ming, et al., July 2018: Contrasting Impacts of radiative forcing in the Southern Ocean versus Southern Tropics on ITCZ position and energy transport in one GFDL climate model. *Journal of Climate*, 31(14), DOI:10.1175/JCLI-D-17-0566.1. **(Citation: 52 times Web of Science; 66 times Google Scholar)**

Selected publications on extreme weather events, MJO, intraseasonal variability, and predictions

1) **Zhao, Ming**, and T R Knutson, 2024: Crucial role of sea surface temperature warming patterns in near-term high-impact weather and climate projection. *npj Climate and Atmospheric Science*, 7, 130, DOI:10.1038/s41612-024-00681-7. **(Citation: 8 times Web of Science; 11 times Google Scholar)**
2) **Zhao, Ming**, 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates. *J. Climate*. DOI:10.1175/JCLI-D-21-0145.1. **(Citation: 38 times Web of Science; 49 times Google Scholar)**
3) **Zhao, Ming**, 2020: Simulations of atmospheric rivers, their variability and response to global warming using GFDL's new high resolution general circulation model. *Journal of Climate*, 33(23), DOI:10.1175/JCLI-D-20-0241.1. **(Citation: 49 times Web of Science; 72 times Google Scholar)**
4) Dong, W, **Ming Zhao**, Zhihong Tan, and V Ramaswamy, 2024: Atmospheric rivers over eastern US affected by Pacific/North America pattern. *Science Advances*, 10(4), DOI:10.1126/sciadv.adj3325. **(Citation: 4 times Web of Science; 6 times Google Scholar)**
5) Liang, W, **Ming Zhao**, Z Tan, T R Knutson, W Dong, and B Zhang, 2024: The direct radiative effect of CO2 increase on summer precipitation in North America. *Geophysical Research Letters*, 51(14), DOI:10.1029/2024GL109202. **(Citation: 1 times Web of Science; 1 times Google Scholar)**
6) Dong, W, **Ming Zhao**, Yi Ming, JP Krasting, and V Ramaswamy, 2023: Simulation of United States mesoscale convective systems using GFDL's new high-resolution general circulation model. *Journal of Climate*, 36(19), DOI:10.1175/JCLI-D-22-0529.16967-6990. **(Citation: 13 times Web of Science; 18 times Google Scholar)**
7) Emanuele, GS, **Ming Zhao**, and K Hodges, 2023: Poleward intensification of midlatitude extreme winds under warmer climate. *npj Climate and Atmospheric Science*, 6, 219, DOI:10.1038/s41612-023-00540-x. **(Citation: 7 times Web of Science; 10 times Google Scholar)**

8) Dong, W., **Ming Zhao**, Y. Ming, and V. Ramaswamy, 2021: Representation of tropical mesoscale convective systems in a general circulation model: Climatology and response to global warming. *Journal of Climate*, 34(14), DOI:10.1175/JCLI-D-20-0535.1. **(Citation: 26 times Web of Science; 39 times Google Scholar)**
9) Yin, J. and **Ming Zhao**, 2021: Influence of the Atlantic meridional overturning circulation on the U.S. extreme cold weather. *Communications Earth and Environment*, 2, 218, DOI:10.1038/s43247-021-00290-9. **(Citation: 7 times Web of Science; 14 times Google Scholar)**
10) Xiang, B., and co-authors including **Ming Zhao**, 2021: S2S Prediction in GFDL SPEAR: MJO diversity and teleconnections, *Bulletin of the American Meteorological Society*. DOI:10.1175/BAMS-D-21-0124.1. **(Citation: 36 times Web of Science; 45 times Google Scholar)**
11) Yin, J., S. M. Griffies, M. Winton, **Ming Zhao**, and L. Zanna, 2020: Response of storm-related extreme sea level along the US Atlantic coast to combined weather and climate forcing. *Journal of Climate*, 33(9), DOI:10.1175/JCLI-D-19-0551.1. **(Citation: 23 times Web of Science; 33 times Google Scholar)**
12) Zhu, Y, T. Li, **Ming Zhao**, and T. Nasuno, 2019: Interaction between MJO and High Frequency Waves over Maritime Continent in Boreal Winter. *Journal of Climate*, 32(13), DOI:10.1175/JCLI-D-18-0511.1. **(Citation: 11 times Web of Science; 13 times Google Scholar)**
13) Jiang, X., A. F. Adames, **Ming Zhao**, D. E. Waliser, and E. Maloney, 2018a: A unified moisture mode framework for seasonality of the Madden-Julian Oscillation. *Journal of Climate,* 31(11), DOI:10.1175/JCLI-D-17-0671.1. **(84 citations Web of Science, 105 times Google Scholar)**
14) Jiang, X., B. Xiang, **Ming Zhao**, T. Li, S-J Lin, Z. Wang, and J-H Chen, 2018b: Intraseasonal tropical cyclogenesis prediction in a global coupled model system. *Journal of Climate,* 31(15), DOI:10.1175/JCLI-D-17-0454.1. **(25 citations Web of Science, 33 times Google Scholar)**
15) Jiang, X., **Ming Zhao**, E. D. Maloney, and D. E. Waliser, 2016: Convective moisture adjustment time-scale as a key factor in regulating model amplitude of the Madden-Julian Oscillation. *Geophysical Research Letters,* 43(19), DOI:10.1002/2016GL070898. **(59 citations Web of Science, 56 times Google Scholar)**
16) Xiang, B., **Ming Zhao**, X. Jiang, S-J Lin, T. Li, X. Fu, and G. A. Vecchi, 2015a: The 3-4 week MJO prediction skill in a GFDL coupled model. *Journal of Climate,* 28(13), DOI:10.1175/JCLI-D-15-0102.1. **(83 citations Web of Science; 109 times Google Scholar)**
17) Xiang, B., S-J Lin, **Ming Zhao**, G. A. Vecchi, T. Li, X. Jiang, L. Harris, and J-H Chen, 2015b: Beyond weather time scale prediction for hurricane Sandy and super typhoon Haiyan in a global climate model. *Monthly Weather Review,* 143(2), DOI:10.1175/MWR-D-14-00227.1. **(56 citations Web of Science; 71 times Google Scholar)**
18) Jiang, X., **Ming Zhao**, and D. E. Waliser, 2012: Modulation of tropical cyclones over the eastern Pacific by the intra-seasonal variability simulated in an AGCM. *Journal of Climate*, 25(19), DOI:10.1175/JCLI-D-11-00531.1. **(Citation: 95 times Web of Science; 94 times Google Scholar)**

Selected publications on studies of convection, clouds, and climate using idealized model hierarchy

1) **Zhao, Ming**, and P. H. Austin, 2005: Life cycle of numerically simulated shallow cumulus clouds. Part I: Transport. *Journal of the Atmospheric Sciences*, 62(5), 1269-1290. **(Citation: 79 times Web of Science; 108 times Google Scholar)**
2) **Zhao, Ming**, and P. H. Austin, 2005: Life cycle of numerically simulated shallow cumulus clouds. Part II: Mixing dynamics. *Journal of the Atmospheric Sciences*, 62(5), 1291-1310. **(Citation: 92 times Web of Science; 138 times Google Scholar)**

3) Held, I. M., **Ming Zhao**, and B. Wyman, 2007: Dynamic radiative-convective equilibria using GCM column physics. *Journal of the Atmospheric Sciences*, 64(1), 228-238. **(Citation: 68 times Web of Science; 100 times Google Scholar)**
4) Held, I. M. and **Ming Zhao**, 2008: Horizontally homogeneous rotating radiative–convective Equilibria at GCM resolution. *Journal of the Atmospheric Sciences*, 65(6), DOI:10.1175/2007JAS2604.1. **(Citation: 54 times Web of Science; 70 times Google Scholar)**
5) Kang, S. M., I. M. Held, D. M. W. Frierson, and **Ming Zhao**, 2008: The response of the ITCZ to extratropical thermal forcing: Idealized slab-ocean experiments with a GCM. *Journal of Climate*, 21(14), DOI:10.1175/2007JCLI2146.1. **(Citation: 544 times Web of Science; 717 times Google Scholar)**
6) Merlis, T. M., **Ming Zhao**, and I. M. Held, 2013: The sensitivity of hurricane frequency to ITCZ changes and radiatively forced warming in aquaplanet simulations. *Geophysical Research Letters*, 40(15), DOI:10.1002/grl.50680. **(Citation: 81 times Web of Science; 121 times Google Scholar)**
7) Merlis, T. M., W. Zhou, I. M. Held, and **Ming Zhao**, 2016: Surface temperature dependence of tropical cyclone-permitting simulations in a spherical model with uniform thermal forcing. *Geophysical Research Letters*, 43(6), DOI:10.1002/2016GL067730. **(Citation: 46 times Web of Science; 65 times Google Scholar)**
8) Ballinger, A., T. M. Merlis, I. M. Held, and **Ming Zhao**, 2015: The sensitivity of tropical cyclone activity to off-equatorial thermal forcing in aquaplanet simulations. *Journal of the Atmospheric Sciences*, 72(6), DOI:10.1175/JAS-D-14-0284.1. **(Citation: 31 times Web of Science; 49 times Google Scholar)**
9) Medeiros, B., B. Stevens, I. M. Held, **Ming Zhao**, D. L. Williamson, J. Olson, and C. S. Bretherton, 2008: Aquaplanets, climate sensitivity, and low clouds. *Journal of Climate*, 21(19), DOI:10.1175/2008JCLI1995.1. **(Citation: 146 times Web of Science; 211 times Google Scholar)**
10) Wyant, M. C. and co-authors including **Ming Zhao**, 2007: A single-column model intercomparison of a heavily drizzling stratocumulus-topped boundary layer. *Journal of Geophysical Research*, D24204, DOI:10.1029/2007JD008536. **(Citation: 39 times Web of Science; 62 times Google Scholar)**
11) Wing, Allison A., and co-authors including **Ming Zhao**, 2020: Clouds and Convective Self-Aggregation in a Multi-Model Ensemble of Radiative-Convective Equilibrium Simulations. *Journal of Advances in Modeling Earth Systems*, 12(9), DOI:10.1029/2020MS002138. **(Citation: 120 times Web of Science; 160 times Google Scholar)**

Selected publications on other general topics of significance

1) Ginoux, P., J. M. Prospero, T. E. Gill, C. Hsu, and **Ming Zhao**, 2012: Global scale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products. *Reviews of Geophysics*, 50, RG3005, DOI:10.1029/2012RG000388. **(Citation: 1091 times Web of Science; 1600 times Google Scholar)**
2) Sheffield, J, and co-authors including **Ming Zhao**, 2013: North American Climate in CMIP5 Experiments. Part II: Evaluation of Historical Simulations of Intra-Seasonal to Decadal Variability. *Journal of Climate*, 26(23), DOI:10.1175/JCLI-D-12-00593.1. **(Citation: 123 times Web of Science; 175 times Google Scholar)**
3) Maloney, E. and co-authors including **Ming Zhao** 2014: North American Climate in CMIP5 Experiments: Part III: Assessment of 21st Century Projections. *Journal of Climate*, 27(6), DOI:10.1175/JCLI-D-13-00273.1. **(Citation: 222 times Web of Science; 334 times Google Scholar)**

4) Hsu, P, T. Li, J.-J. Luo, H. Murakami, A. Kitoh, and **Ming Zhao**, 2012: Increase of global monsoon area and precipitation under global warming: A robust signal? *Geophysical Research Letters*, 39, L06701, DOI:10.1029/2012GL051037. **(Citation: 127 times Web of Science; 175 times Google Scholar)**
5) Orbe, C, L. V. Roekel, A. F. Adames, A. Dezfuli, J. Fasullo, P. J. Gleckler, J. Lee, W. Li, L. Nazarenko, G. A. Schmidt, K. R. Sperber, and **Ming Zhao**, 2020: Representation of Modes of Variability in 6 U.S. Climate Models. *Journal of Climate*, 33(17), DOI:10.1175/JCLI-D-19-0956.1 . **(Citation: 30 times Web of Science; 39 times Google Scholar)**
6) Hill, S A., Yi Ming, Isaac M Held, and **Ming Zhao**, August 2017: A moist static energy budget-based analysis of the Sahel rainfall response to uniform oceanic warming. *Journal of Climate*, 30(15), DOI:10.1175/JCLI-D-16-0785.1. **(Citation: 52 times Web of Science; 73 times Google Scholar)**
7) Maloney, Eric, and co-authors including **Ming Zhao**, 2019: Process-Oriented Evaluation of Climate and Weather Forecasting Models. *Bulletin of the American Meteorological Society*, 100(9), DOI:10.1175/BAMS-D-18-0042.1. **(Citation: 52 times Web of Science; 70 times Google Scholar)**
8) Wing, A A., S J Camargo, A Sobel, D Kim, Y Moon, H Murakami, K A Reed, G A Vecchi, M F Wehner, C M Zarzycki, and **Ming Zhao**, 2019: Moist static energy budget analysis of tropical cyclone intensification in high-resolution climate models. *Journal of Climate*, 32(18), DOI:10.1175/JCLI-D-18-0599.1. **(Citation: 48 times Web of Science; 64 times Google Scholar)**

Summary of Major Accomplishments and Research Output

1) **Development of GFDL's HiRAM and Research on Hurricane–Climate Connections**
I was the lead developer of GFDL's High-Resolution Global Atmospheric Model (HiRAM), which led to a major advancement in GFDL's capability to simulate tropical cyclones (TCs), their historical variability, and future changes in a warming climate (Zhao et al., 2009). HiRAM was one of the GFDL models that participated in CMIP5 and contributed to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). It also played a key role in motivating the formation of the US CLIVAR Hurricane Working Group, which conducted worldwide, multi-institutional investigations into hurricane-climate connections using high-resolution global climate models (GCMs). HiRAM helped drive the development of GFDL's subseasonal-to-seasonal prediction system for tropical cyclones, the Madden-Julian Oscillation (MJO), and other extreme weather events. I have published five lead-author papers using HiRAM, along with numerous co-authored papers (e.g., Zhao et al., 2010, 2012, Zhao and Held 2010, 2012, Held and Zhao 2011), all of which are extensively cited in the literature. In particular, the HiRAM documentation paper (Zhao et al., 2009) has been cited **555** times according to the Web of Science Core Collection and **791** times according to Google Scholar as of June 2025. HiRAM has been used worldwide and has impacted numerous subsequent studies on TC-climate connections, TC seasonal predictions, global modeling of TC activities, and TC intraseasonal variability (e.g.,Vecchi et al., 2011, Walsh et al., 2015, Knutson et al., 2013, 2015, Camargo et al., 2014, Villarini et al., 2014, Kim et al., 2014). Simulation work with HiRAM contributed significantly to a GFDL Group Gold Medal awarded by the U.S. Department of Commerce in 2011, recognizing *"sustained high-quality research, scientific assessment and leadership resulting in an improved understanding of the impact of anthropogenic climate change on past and future*

hurricane activity".[2]

2) **Development of GFDL's Latest-Generation Global Atmospheric Model (AM4), Coupled Physical Climate Model (CM4), Earth System Model (ESM4), and Prediction System (SPEAR)**
I co-led the GFDL Model Development Team (MDT) Atmospheric Working Group (AWG) from 2013 to 2015 and led it from 2015 to 2018 for the development of AM4. I also co-led the MDT Coupled Working Group (CWG) from 2013 to 2019 for the development of CM4. My responsibilities included developing strategic plans, organizing meetings, analyzing and discussing model results, proposing and creating new configurations and versions of AM4, developing and integrating new moist physics parameterizations, and diagnosing and resolving critical issues that arose during the development of AM4. My work on CM4 focused on reducing biases in sea surface temperatures (SSTs), the El Niño–Southern Oscillation (ENSO), the double Intertropical Convergence Zone (ITCZ) problem, and the global SST response to historical and present-day radiative forcing. A central goal of this effort was to improve climate simulations by reducing biases in AM4 and CM4 through improved atmospheric moist physics. AM4 is documented in Zhao et al., (2018a,2018b), and CM4 is documented in Held et al., (2019). All three papers are recognized as Web of Science Highly Cited Papers, ranking in the top 1% of the academic field of Geosciences based on the citation threshold for the field and publication year. In particular, the two AM4 papers (Part I and II) have received **461** citations in the Web of Science Core Collection and **597** citations on Google Scholar as of June 2025 since its publication in 2018. Both AM4 and CM4 are widely used around the world. AM4 serves as the foundation for all latest-generation GFDL models, including CM4, the Earth System Model (ESM4), and the latest GFDL subseasonal-to-decadal prediction system (SPEAR), and GFDL's full chemistry-climate model (AM4.1). I am a co-author of each of the model documentation papers, all of which are extensively cited by the global research community. AM4, CM4, and ESM4 have participated in CMIP6, and contributed to the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6). ESM4 received the 2022 NOAA Administrator's Award for advancing the understanding of the Earth System by developing and applying NOAA's state-of-the-art Coupled Carbon-Chemistry-Climate model. GFDL SPEAR has been running in real-time for short-term climate prediction. It has replaced earlier GFDL prediction systems and contributed to the North American Multi-Model Ensemble, as well as a wide range of research and applications both within and outside of NOAA. My leadership in climate model development, along with other research achievements, was recognized by the American Geophysical Union's (AGU) with the 2022 Atmospheric Sciences Ascent Award for growing research accomplishments and leadership in climate model development.

3) **Studies of Clouds, Cloud Feedbacks, and Climate Sensitivity, and Co-Leadership of the GFDL Cloud Climate Initiative (CCI)**
Since 2013, I have co-led the GFDL Cloud Climate Initiative (CCI), authoring five first-author papers and contributing to numerous co-authored publications. Zhao (2014) identified key physical processes, such as cumulus mixing and precipitation microphysics, and introduced critical diagnostic quantities, such as precipitation efficiency or cloud detrainment efficiency, into GCMs to better understand the effects of convection on clouds and cloud feedbacks. This paper has inspired numerous subsequent studies, including a chapter titled *"Precipitation Efficiency and Climate Sensitivity"* in the AGU Monograph Series on *Clouds and Their Climatic Impacts: Radiation, Circulation, and Precipitation* (2023). Zhao et al. (2016) used a version of AM4 with

[2] I was not included among the award recipients because the award is restricted to federal employees, and I was not a federal employee at the time.

modifications limited to the treatment of convective microphysics to demonstrate that convective precipitation microphysics, one of the most uncertain processes in GCM parameterizations, can profoundly affect cloud feedbacks and climate sensitivity on its own. Moreover, its impact can be better understood through the concept of precipitation efficiency. This paper received the 2018 NOAA OAR Outstanding Scientific Paper Award and helped motivate the NOAA CPO MAPP Climate Sensitivity Task Force, which I co-led. Both papers are well-cited in the literature, with a total of **215** citations in the Web of Science Core Collection and **303** citations on Google Scholar as of June 2025. More recently, Zhao (2022a) led an investigation into the equilibrium climate sensitivity (ECS) in GFDL's latest climate models, CM4 and SPEAR. Using a series of coupled and uncoupled simulations, Zhao (2022a) identified and quantified three major processes that contributed to an increase in CM4's ECS compared to earlier-generation GFDL models. These processes include changes in vegetation, Southern Hemisphere sea-ice concentrations, and sea surface temperature (SST) warming patterns. This paper also demonstrated the limitations of the traditional Cess approach (i.e., uniform SST warming) in studies of cloud feedbacks and climate sensitivity and proposed a new, modified framework for understanding cloud feedbacks and climate sensitivity using atmosphere-only models. In 2024, I published two first-author papers: one (Zhao and Knutson, 2024) on the crucial role of SST warming patterns in near-term climate projections, published in *Nature*'s *npj Climate and Atmospheric Science;* and the other (Zhao, 2024) on the cloud radiative effect associated with daily weather regimes, published in AGU's *Geophysical Research Letters*. Both papers have already garnered significant attention from the global research community, attracting numerous inquiries from colleagues worldwide and receiving substantial download counts. For example, Zhao and Knutson (2024) demonstrated that climate model biases in SST trend patterns have profound implications for near-term projections of high-impact storm statistics, including the frequency of atmospheric rivers, tropical storms and mesoscale convection systems, as well as for hydrological and climate sensitivity. In particular, if the future SST warming pattern continues to resemble the observed pattern from the past few decades rather than the model-predicted patterns, these results suggest: 1) a drastically different projection of high-impact storms and associated hydroclimate changes, especially over the Western Hemisphere; 2) stronger global hydrological sensitivity; and 3) substantially less global warming due to enhanced negative feedbacks and lower climate sensitivity. The paper has already been cited **8** times in the Web of Science Core Collection and **11** times on Google Scholar since its publication last year. It has also attracted media attention from sources such as *Climate.gov* and the American Enterprise Institute.

4) **Studies on Other High-Impact Weather Events (e.g., Atmospheric Rivers, Mesoscale Convective Systems, Extreme Cold Weather, and Storm-Related Extreme Sea Levels) and Their Response to Global Warming**

In recent years, I have expanded my studies on tropical cyclones (TCs) and climate to include other high-impact weather events. For example, Zhao (2020) investigated atmospheric rivers (ARs), their variability, and their changes under warmer climates. The study demonstrated the superior performance of the GFDL high-resolution AM4 simulations in capturing present-day AR statistics and variability. Previous studies on AR responses to global warming typically used an integrated vapor transport (IVT) threshold based on present-day conditions to detect ARs, which led to a large increase in the frequency of AR conditions in warmer climates. However, Zhao (2020) argued that it is essential to use an IVT threshold that accounts for the increased moisture due to global warming, particularly when the magnitude of warming is substantial. As a result, Zhao (2020) found a much smaller increase in AR frequency but a substantially larger increase in

AR intensity with warming. This paper was highlighted in the January 2021 issue of the *Bulletin of the American Meteorological Society* in the 'Papers of Note' section and has been widely cited since its publication. It has received **49** citations in the Web of Science Core Collection, and **72** citations on Google Scholar. Zhao (2022b) used satellite observations, reanalysis data, and high-resolution AM4 to quantify the collective role of AR, tropical storms (TS), and mesoscale convective system (MCS) in producing both global and regional mean and extreme precipitation. This is the first-ever study to quantify their collective contribution to both mean and extreme precipitation on a global scale. The study not only demonstrates the model's capability in simulating storm-associated mean and extreme precipitation, but also reveals the changing nature of storm-associated precipitation in a warmer climate. This work has important implications for future flash flood-driven disasters and water resource management. It has also been highly cited since its publication in 2022, with **38** citations in the Web of Science Core Collection and **49** in Google Scholar. My recent work was recognized with the 2022 NOAA OAR Employee Of the Year Award for exemplary scientific leadership in the development and utilization of high-resolution climate models for studying extreme weather and extreme precipitation under climate change. In addition to the two single-author papers mentioned above, both highlighted in GFDL's quarterly bulletin, I have co-authored numerous studies on weather–climate connections. These include studies on ARs (Dong et al., 2024a, 2025), published in *Science Advances and Nature's npj Climate and Atmospheric Science,* respectively; investigations into MCSs (Dong et al., 2021, 2023, 2024b) using high-resolution AM4 simulations; a study on the effects of ocean circulation on extreme cold weather events in the U.S. (Yin and Zhao, 2021); and an analysis of storm-related extreme sea levels along the U.S. Atlantic Coast (Yin et al., 2020), among many others.

5) **Development of a Convection Parameterization Scheme and Improvements in Tropical Cyclone (TC) and Madden–Julian Oscillation (MJO) Predictions**
As a core developer of GFDL AM3, I implemented, further developed, and optimized the University of Washington Shallow Cumulus Scheme (UWShCu), and unified the plume model used by both UWShCu and Donner's deep convection scheme to enhance the model's consistency and efficiency. My efforts led to major improvements in AM3's climate simulations and contributed to the model receiving a *Group Gold Medal from the U.S. Department of Commerce in 2012*[3]. The GFDL AM3 documentation paper has received **835** citations in the Web of Science Core Collection and **1142** in Google Scholar. During my development of HiRAM, I further adapted the UWShCu scheme to represent both shallow and deep convection. [See Zhao et al. (2009), Appendix, for details on my modifications to the UWShCu scheme, as well as a simple statistical cloud scheme]. During my development of AM4/CM4, I further advanced the convection scheme by introducing an additional deep plume to better represent deep convection (Zhao et al. 2016, Zhao et al. 2018b). The new Double Plume Convection (DPC) scheme emphasizes the importance of a non-intrusive convection parameterization, allowing for a smoother transition between parameterized convection and explicit (large-scale) clouds. This scheme has been instrumental in many recent improvements in GFDL models, particularly in simulating tropical transients such as tropical cyclones, mesoscale convective systems, and the Madden-Julian Oscillation (MJO). Additionally, it improves model simulations of large-scale atmospheric circulation, mean precipitation, cloud properties, and cloud radiative effects. The DPC scheme has been used not only in the latest GFDL climate and Earth System Models (CM4,

[3] I was not included among the award recipients because the award is restricted to federal employees, and I was not a federal employee at the time.

ESM4) but also in GFDL's latest prediction systems (SPEAR). When run in forecast mode, the DPC scheme has substantially improved the models' retrospective forecasts of the MJO, surface air temperature, and TC genesis (e.g., Xiang et al. 2015a, 2015b, 2019, 2022, 2023). Recently, the DPC scheme was also adopted in a version of NCAR's CAM5 model (Chu et al. 2021).

6) **Studies of Tropical Convection, Clouds, and Climate through the Development and Use of Model Hierarchies with Varying Complexities**
Throughout my research career, I have contributed to the development and application of a variety of models with varying complexities to investigate convection, clouds, climate, and their interactions, as well as the impact of physics parameterizations on these processes. The models include large-eddy-simulation (LES) models (e.g., Zhao and Austin 2005a,b), cloud resolving models (e.g., Wing et al., 2020), single-column models (SCMs, e.g., Zhao and Austin 2003, Wyant et al., 2007, Zhang et al., 2013), doubly periodic dynamical radiative-convective equilibrium models using GCM physics with (Held and Zhao 2008) and without ambient rotation (Held et al. 2007), aquaplanet models (APM, e.g. Kang et al., 2008, Medeiros et al., 2008, Merlis et al., 2013, 2016, Ballinger et al., 2015), uncoupled global atmosphere and land models (AGCMs, e.g., Zhao 2014, Zhao et al., 2016), coupled ocean-atmosphere-land-sea ice physical climate models (CGCMs, e.g., Zhao 2022a, Held et al., 2019), and full Earth System Models (ESM, e.g., Dunne et al., 2020). My work, along with the idealized models I developed, has not only motivated but also provided valuable guidance and support to numerous graduate students and postdocs at GFDL and Princeton University. These frameworks have fostered collaborative research, facilitated the exploration of complex atmospheric processes, and driven innovation and progress in the field.

Full refereed publication list:

Submitted and Accepted

1. Z. Tan and Ming Zhao, 04/2025: Impact of the NCEP TKE-based Eddy-Diffusivity Mass-Flux boundary layer scheme on the climatology and warming response of GFDL AM4.0 Model. *Journal of Advances in Modeling Earth Systems.* Submitted.
2. Prange M, Ming Zhao, E. Shevliakova, S. Malyshev, and M Hong, 04/2025: Relating the thermodynamic warming response of precipitation and streamflows across the contiguous United States *npj Climate and Atmospheric Science*. Submitted.
3. Chang, C-C, Z Wang, Z Yan, Ming Zhao, and L R Leung, 04/2025: Future projection of summertime subtropical stationary waves and implication for tropical cyclone activity. *npj Climate and Atmospheric Science.* Submitted.
4. Sandro W. Lubis, Chuan-Chieh Chang, Samson Hagos, Ming Zhao, Ziming Chen, Karthik Balaguru, L. Ruby Leung, 06/2025: Cross-Equatorial Northerly Surges in a Warmer Climate. *npj Climate and Atmospheric Science.* Submitted.
5. Zhou W, L R Leung, C-C Chang, Ming Zhao, H-H Hsu, H-C Liang, K Balaguru, and J Lu, 01/2025: Pacific variability dominated past poleward migration of tropical cyclones. *Geophysical Research Letters*. Submitted.
6. Zhang, G, M Rao, J Yuval, S Hoyer, D Kochkov, Ming Zhao, 06/2025: Advancing Seasonal Prediction of Tropical Cyclone Activity with a Hybrid AI-Physics Climate Model, Environ. Res. Lett. Accepted with revision.

7. Liu P, L A Reed. Ming Zhao, S. Garner, and Minghua Zhang, 06/2025: Rapid Shrinking of the Warming Hole over the United States in ERA5 and SPEAR. *JGR. Atmosphere.* Submitted.
8. Dong, W, Ming Zhao, L. Harris, K-Y Cheng, L Zhou and V Ramaswamy, 02/2025: Response of global mesoscale convective systems to increased CO2 and uniform SST warming in a Global Storm-resolving Model. *Earth's Future.* Accepted.
9. Griffies, SM, and co-authors including Ming Zhao, 04/2025, The GFDL-CM4X climate model hierarchy, Part I: model description and thermal properties. *Journal of Advances in Modeling Earth Systems,* Accepted with minor revisions.
10. Griffies, SM, and co-authors including Ming Zhao, 04/2025, The GFDL-CM4X climate model hierarchy, Part II: case studies. *Journal of Advances in Modeling Earth Systems,* Accepted with minor revisions.

Published

1. Falasca, Fabrizio, Aurora Basinski-Ferris, Laure Zanna, and Ming Zhao, July 2025: A fluctuation-dissipation theorem perspective on radiative responses to temperature perturbations. *Journal of Climate*, 38(14), DOI:10.1175/JCLI-D-24-0479.13239-3260.
Abstract
2. Guo, Huan, Levi G Silvers, David J Paynter, Wenhao Dong, Songmiao Fan, Xianwen Jing, Ryan J Kramer, Kristopher Rand, Kentaroh Suzuki, Yuying Zhang, and Ming Zhao, June 2025: Assessing clouds in GFDL's AM4.0 with different microphysical parameterizations using the satellite simulator package COSP. *Earth and Space Science*, 12(6), DOI:10.1029/2024EA004053.
3. Dong, Wenhao, Ming Zhao, Lucas Harris, Kai-Yuan Cheng, Linjiong Zhou, and V Ramaswamy, June 2025: Response of global mesoscale convective systems to increased CO2 and uniform SST warming in a global storm-resolving model. *Earth's Future*, 13(6), DOI:10.1029/2024EF005776.
Abstract
4. Chang, Chuan-Chieh, Ming Zhao, Sandro W Lubis, Ziming Chen, Karthik Balaguru, Samson Hagos, L Ruby Leung, and Wenyu Zhou, June 2025: Are North Atlantic tropical cyclones modulated by the Madden-Julian Oscillation in HighResMIP AGCMs? *Journal of Climate*, 38(12), DOI:10.1175/JCLI-D-24-0509.12891-2916.
Abstract
5. Wall, Casey J., David J Paynter, Yi Qin, Matvey Debolskiy, Margaret L Duffy, Takuro Michibata, Brandon M Duran, Nicholas J Lutsko, Po-Lun Ma, Brian Medeiros, Trude Storelvmo, and Ming Zhao, June 2025: Decomposing cloud radiative feedbacks by cloud-top phase. *Journal of Climate*. DOI:10.1175/JCLI-D-24-0538.1.
Abstract
6. Liu, Ping, Ming Zhao, Stephen T Garner, and Allan Cruz-Perez,June 2025.: Impact of mean-state biases on Northern Hemisphere winter blocking in GFDL AM4 and CM4. *Journal of Climate*. DOI:10.1175/JCLI-D-24-0390.1.
Abstract
7. Dong, Wenhao, Ming Zhao, Huan Guo, Lucas Harris, Kai-Yuan Cheng, Linjiong Zhou, and V Ramaswamy, May 2025: Comparison of global mesoscale convective systems simulation in a global storm-resolving model and a high-resolution general circulation model. *Journal of Climate*, 38(10), DOI:10.1175/JCLI-D-24-0303.12339-2356.
Abstract
8. Dong, Wenhao, Ming Zhao, Zhihong Tan, and V Ramaswamy, March 2025: Opposing trends in winter atmospheric river over the western and eastern US during the past four decades. *npj*

Climate and Atmospheric Science, 8, 129, DOI:10.1038/s41612-025-00998-x.
Abstract

9. Gentile, Emanuele S., Lucas Harris, Ming Zhao, Kevin Hodges, Zhihong Tan, Kai-Yuan Cheng, and Linjiong Zhou, January 2025: Response of extreme North Atlantic midlatitude cyclones to a warmer climate in the GFDL X-SHiELD kilometer-scale global storm-resolving model. *Geophysical Research Letters*, 52(2), DOI:10.1029/2024GL112570.
   Abstract
10. Hsieh, Tsung-Lin, Lucas Harris, Kai-Yuan Cheng, Alex Kaltenbaugh, Linjiong Zhou, Liwei Jia, and Ming Zhao, March 2025: Western United States wintertime precipitation response to warming: an assessment in a global storm-resolving model. *Climate Dynamics*, 63, 165, DOI:10.1007/s00382-025-07651-6.
    Abstract
11. Liu, Ping, Kevin A Reed, Ming Zhao, Stephen T Garner, Ngar-Cheung Lau, Levi G Silvers, and Brian A Colle, April 2025: Record-breaking persistent high-pressure systems fueled unprecedented Canadian wildfire disasters in 2023. *Environmental Research Communications*, 7(4), DOI:10.1088/2515-7620/adc6de.
    Abstract
12. Roberts, Malcolm J., Kevin A Reed, Qing Bao, Joseph J Barsugli, Suzana J Camargo, Louis-Philippe Caron, Ping Chang, Cheng-Ta Chen, Hannah M Christensen, Gokhan Danabasoglu, Ivy Frenger, Neven S Fuckar, Shabeh ul Hasson, Helene T Hewitt, Huanping Huang, Daehyun Kim, Chihiro Kodama, Michael Lai, L Ruby Leung, Ryo Mizuta, Paulo Nobre, Pablo Ortega, Dominique Paquin, Christopher D Roberts, Enrico Scoccimarro, Jon Seddon, Anne Marie Treguier, Chia-Ying Tu, Paul A Ullrich, Pier Luigi Vidale, Michael F Wehner, Colin M Zarzycki, Bosong Zhang, Wei Zhang, and Ming Zhao, March 2025: High-Resolution Model Intercomparison Project phase 2 (HighResMIP2) towards CMIP7. *Geoscientific Model Development*, 18(4), DOI:10.5194/gmd-18-1307-20251307-1332.
    Abstract
13. Bloch-Johnson, Jonah, Maria A A Rugenstein, Marc J Alessi, Cristian Proistosescu, Ming Zhao, Bosong Zhang, Andrew I L Williams, Jonathan M Gregory, Jason N S Cole, Yue Dong, Margaret L Duffy, Sarah M Kang, and Chen Zhou, February 2024: The Green's Function Model Intercomparison Project (GFMIP) protocol. *Journal of Advances in Modeling Earth Systems*, 16(2), DOI:10.1029/2023MS003700.
    Abstract
14. Dogar, Muhammad M., Masatomo Fujiwara, Ming Zhao, Masamichi Ohba, and Yu Kosaka, January 2024: ENSO and NAO linkage to strong volcanism and associated post-volcanic high-latitude winter warming. *Geophysical Research Letters*, 51(1), DOI:10.1029/2023GL106114.
    Abstract
15. Dong, Wenhao, Ming Zhao, Zhihong Tan, and V Ramaswamy, January 2024: Atmospheric rivers over eastern US affected by Pacific/North America pattern. *Science Advances*, 10(4), DOI:10.1126/sciadv.adj3325.
    Abstract
16. Dong, Wenhao, Ming Zhao, Lucas Harris, Kai-Yuan Cheng, Linjiong Zhou, and V Ramaswamy, November 2024: Contrasting response of mesoscale convective systems occurrence over tropical land and ocean to increased sea surface temperature. *Geophysical Research Letters*, 51(21), DOI:10.1029/2024GL109251.
    Abstract
17. Gentile, Emanuele S., Ming Zhao, Vincent E Larson, Colin M Zarzycki, and Zhihong Tan, May 2024: The effect of coupling between CLUBB turbulence scheme and surface momentum flux on

global wind simulations. *Journal of Advances in Modeling Earth Systems*, 16(5), DOI:10.1029/2024MS004295.
Abstract

18. Liang, Wengui, Ming Zhao, Zhihong Tan, Thomas R Knutson, Wenhao Dong, and Bosong Zhang, July 2024: The direct radiative effect of CO2 increase on summer precipitation in North America. *Geophysical Research Letters*, 51(14), DOI:10.1029/2024GL109202.
Abstract
19. Lin, Meiyun, Larry W Horowitz, Ming Zhao, Lucas Harris, Paul Ginoux, John P Dunne, Sergey Malyshev, Elena Shevliakova, Hamza Ahsan, Stephen T Garner, Fabien Paulot, Arman Pouyaei, Steven J Smith, Yuanyu Xie, Niki Zadeh, and Linjiong Zhou, April 2024: The GFDL variable-resolution global chemistry-climate model for research at the nexus of US climate and air quality extremes. *Journal of Advances in Modeling Earth Systems*, 16(4), DOI:10.1029/2023MS003984.
Abstract
20. Zhang, Bosong, Leo J Donner, Ming Zhao, and Zhihong Tan, September 2024: Improved precipitation diurnal cycle in GFDL climate models with non-equilibrium convection. *Journal of Advances in Modeling Earth Systems*, 16(9), DOI:10.1029/2024MS004315.
Abstract
21. Zhao, Ming, May 2024: Cloud radiative effects associated with daily weather regimes. *Geophysical Research Letters*, 51(10), DOI:10.1029/2024GL109090.
Abstract
22. Zhao, Ming, and Thomas R Knutson, June 2024: Crucial role of sea surface temperature warming patterns in near-term high-impact weather and climate projection. *npj Climate and Atmospheric Science*, 7, 130, DOI:10.1038/s41612-024-00681-7.
Abstract
23. Chang, Chuan-Chieh, Zhuo Wang, Mingfang Ting, and Ming Zhao, February 2023: Summertime subtropical stationary waves in the northern hemisphere: Variability, forcing mechanisms, and impacts on tropical cyclone activity. *Journal of Climate*, 36(3), DOI:10.1175/JCLI-D-22-0233.1753-773.
Abstract
24. Dogar, Muhammad M., Leon Hermanson, Adam A Scaife, Daniele Visioni, Ming Zhao, Ibrahim Hoteit, Hans-F Graf, Muhammad Ahmad Dogar, Mansour Almazroui, and Masatomo Fujiwara, January 2023: A review of El Niño Southern Oscillation linkage to strong volcanic eruptions and post-volcanic winter warming. *Earth Systems and Environment*, 7, DOI:10.1007/s41748-022-00331-z15-42.
Abstract
25. Dong, Wenhao, Ming Zhao, Yi Ming, John P Krasting, and V Ramaswamy, September 2023: Simulation of United States mesoscale convective systems using GFDL's new high-resolution general circulation model. *Journal of Climate*, 36(19), DOI:10.1175/JCLI-D-22-0529.16967-6990.
Abstract
26. Falasca, Fabrizio, Andrew Brettin, Laure Zanna, Stephen M Griffies, Jianjun Yin, and Ming Zhao, June 2023: Exploring the nonstationarity of coastal sea level probability distributions. *Environmental Data Science*, 2, e16, DOI:10.1017/eds.2023.10.
Abstract
27. Gentile, Emanuele S., Ming Zhao, and Kevin Hodges, December 2023: Poleward intensification of midlatitude extreme winds under warmer climate. *npj Climate and Atmospheric Science*, 6, 219, DOI:10.1038/s41612-023-00540-x.
Abstract

28. Hsieh, Tsung-Lin, Bosong Zhang, Wenchang Yang, Gabriel A Vecchi, Ming Zhao, Brian J Soden, and Chenggong Wang, August 2023: The influence of large-scale radiation anomalies on tropical cyclone frequency. *Journal of Climate*, 36(16), DOI:10.1175/JCLI-D-22-0449.15431–5441.
    Abstract
29. Kieu, Chanh, Ming Zhao, Zhihong Tan, Bosong Zhang, and Thomas R Knutson, April 2023: On the role of sea surface temperature in the clustering of global tropical cyclone formation. *Journal of Climate*, 36(9), DOI:10.1175/JCLI-D-22-0623.13145-3162.
    Abstract
30. Xiang, Baoqiang, Lucas Harris, Thomas L Delworth, Bin Wang, Guosen Chen, Jan-Huey Chen, Spencer K Clark, William F Cooke, Kun Gao, J Jacob Huff, Liwei Jia, Nathaniel C Johnson, Sarah B Kapnick, Feiyu Lu, Colleen McHugh, Yongqiang Sun, Mingjing Tong, Xiaosong Yang, Fanrong Zeng, Ming Zhao, Linjiong Zhou, and Xiaqiong Zhou, March 2023: Prediction of diverse MJO in the GFDL SPEAR model. *Bulletin of the American Meteorological Society*, 104(3), DOI:10.1175/BAMS-D-21-0124.A169-171.
31. Zhang, Bosong, Ming Zhao, and Zhihong Tan, February 2023: Using a Green’s Function approach to diagnose the pattern effect in GFDL AM4 and CM4. *Journal of Climate*, 36(4), DOI:10.1175/JCLI-D-22-0024.11105–1124.
    Abstract
32. Zhang, Bosong, Ming Zhao, Haozhe He, Brian J Soden, Zhihong Tan, Baoqiang Xiang, and Chenggong Wang, September 2023: The dependence of climate sensitivity on the meridional distribution of radiative forcing. *Geophysical Research Letters*, 50(18), DOI:10.1029/2023GL105492.
    Abstract
33. Chu, Wenchao, Yanluan Lin, and Ming Zhao, January 2022: Implementation and evaluation of a double-plume convective parameterization in NCAR CAM5. *Journal of Climate*, 35(2), DOI:10.1175/JCLI-D-21-0267.1617-637.
    Abstract
34. Dong, Wenhao, Ming Zhao, Yi Ming, and V Ramaswamy, December 2022: Significant increase in sea surface temperature at the genesis of tropical mesoscale convective systems. *Geophysical Research Letters*, 49(24), DOI:10.1029/2022GL101950.
    Abstract
35. Guo, Huan, Yi Ming, Songmiao Fan, Andrew T Wittenberg, Rong Zhang, Ming Zhao, and Linjiong Zhou, December 2022: Performance of two-moment stratiform microphysics with prognostic precipitation in GFDL's CM4.0. *Journal of Advances in Modeling Earth Systems*, 14(12), DOI:10.1029/2022MS003111.
    Abstract
36. Hsieh, Tsung-Lin, Wenchang Yang, Gabriel A Vecchi, and Ming Zhao, April 2022: Model spread in the tropical cyclone frequency and seed propensity index across global warming and ENSO-like perturbations. *Geophysical Research Letters*, 49(7), DOI:10.1029/2021GL097157.
    Abstract
37. Liu, Ping, Kevin A Reed, Stephen T Garner, Ming Zhao, and Yuejian Zhu, August 2022: Blocking simulations in GFDL GCMs for CMIP5 and CMIP6. *Journal of Climate*, 35(15), DOI:10.1175/JCLI-D-21-0456.15053-5070.
    Abstract
38. Moon, Yumin, Daehyun Kim, Allison A Wing, Suzana J Camargo, and Ming Zhao, et al., November 2022: An evaluation of tropical cyclone rainfall structures in the HighResMIP simulations against satellite observations. *Journal of Climate*, 35(22), DOI:10.1175/JCLI-D-21-0564.13715-3738.
    Abstract

39. Xiang, Baoqiang, Lucas Harris, Thomas L Delworth, Bin Wang, Guosen Chen, Jan-Huey Chen, Spencer K Clark, William F Cooke, Kun Gao, J Jacob Huff, Liwei Jia, Nathaniel C Johnson, Sarah B Kapnick, Feiyu Lu, Colleen McHugh, Yongqiang Sun, Mingjing Tong, Xiaosong Yang, Fanrong Zeng, Ming Zhao, Linjiong Zhou, and Xiaqiong Zhou, February 2022: S2S prediction in GFDL SPEAR: MJO diversity and teleconnections. *Bulletin of the American Meteorological Society*, 103(2), DOI:10.1175/BAMS-D-21-0124.1.
Abstract
40. Zhao, Ming, January 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates. *Journal of Climate*, 35(2), DOI:10.1175/JCLI-D-21-0145.1479-497.
Abstract
41. Zhao, Ming, September 2022: An investigation of the effective climate sensitivity in GFDL's new climate models CM4.0 and SPEAR. *Journal of Climate*, 35(17), DOI:10.1175/JCLI-D-21-0327.15637-5660.
Abstract
42. Dong, Wenhao, Ming Zhao, Yi Ming, and V Ramaswamy, July 2021: Representation of tropical mesoscale convective systems in a general circulation model: Climatology and response to global warming. *Journal of Climate*, 34(14), DOI:10.1175/JCLI-D-20-0535.1.
Abstract
43. Guo, Huan, Yi Ming, Songmiao Fan, Linjiong Zhou, Lucas Harris, and Ming Zhao, June 2021: Two-moment bulk cloud microphysics with prognostic precipitation in GFDL's Atmosphere Model AM4.0: configuration and performance. *Journal of Advances in Modeling Earth Systems*, 13(6), DOI:10.1029/2020MS002453.
Abstract
44. Yin, Jianjun, and Ming Zhao, October 2021: Influence of the Atlantic meridional overturning circulation on the U.S. extreme cold weather. *Communications Earth and Environment*, 2, 218, DOI:10.1038/s43247-021-00290-9.
Abstract
45. Zhang, Gan, Levi G Silvers, Ming Zhao, and Thomas R Knutson, March 2021: Idealized aquaplanet simulations of tropical cyclone activity: Significance of temperature gradients, Hadley circulation, and zonal asymmetry. *Journal of the Atmospheric Sciences*, 78(3), DOI:10.1175/JAS-D-20-0079.1877-902.
Abstract
46. Camargo, Suzana J., C F Giulivi, Adam H Sobel, Allison A Wing, D Kim, Yumin Moon, Jeffrey D Strong, A Del Genio, M Kelley, Hiroyuki Murakami, Kevin A Reed, Enrico Scoccimarro, Gabriel A Vecchi, Michael F Wehner, Colin M Zarzycki, and Ming Zhao, June 2020: Characteristics of model tropical cyclone climatology and the large-scale environment. *Journal of Climate*, 33(11), DOI:10.1175/JCLI-D-19-0500.1.
Abstract
47. Delworth, Thomas L., William F Cooke, Alistair Adcroft, Mitchell Bushuk, Jan-Huey Chen, Krista A Dunne, Paul Ginoux, Richard G Gudgel, Robert Hallberg, Lucas Harris, Matthew J Harrison, Nathaniel C Johnson, Sarah B Kapnick, Shian-Jiann Lin, Feiyu Lu, Sergey Malyshev, P C D Milly, Hiroyuki Murakami, Vaishali Naik, Salvatore Pascale, David J Paynter, Anthony Rosati, M Daniel Schwarzkopf, Elena Shevliakova, Seth D Underwood, Andrew T Wittenberg, Baoqiang Xiang, Xiaosong Yang, Fanrong Zeng, Honghai Zhang, Liping Zhang, and Ming Zhao, March 2020: SPEAR – the next generation GFDL modeling system for seasonal to multidecadal prediction and projection. *Journal of Advances in Modeling Earth Systems*, 12(3), DOI:10.1029/2019MS001895.
Abstract

48. Dunne, John P., Larry W Horowitz, Alistair Adcroft, Paul Ginoux, Isaac M Held, Jasmin G John, John P Krasting, Sergey Malyshev, Vaishali Naik, Fabien Paulot, Elena Shevliakova, Charles A Stock, Niki Zadeh, V Balaji, Chris Blanton, Krista A Dunne, Christopher Dupuis, Jeffrey W Durachta, Raphael Dussin, Paul P G Gauthier, Stephen M Griffies, Huan Guo, Robert Hallberg, Matthew J Harrison, Jian He, William J Hurlin, Colleen McHugh, Raymond Menzel, P C D Milly, Sergei Nikonov, David J Paynter, Jeff J Ploshay, Aparna Radhakrishnan, Kristopher Rand, Brandon G Reichl, Thomas E Robinson, M Daniel Schwarzkopf, Lori T Sentman, Seth D Underwood, Hans Vahlenkamp, Michael Winton, Andrew T Wittenberg, Bruce Wyman, Yujin Zeng, and Ming Zhao, November 2020: The GFDL Earth System Model version 4.1 (GFDL-ESM 4.1): Overall coupled model description and simulation characteristics. *Journal of Advances in Modeling Earth Systems*, 12(11), DOI:10.1029/2019MS002015.
Abstract
49. Horowitz, Larry W., Vaishali Naik, Fabien Paulot, Paul Ginoux, John P Dunne, Jingqiu Mao, Jordan L Schnell, Xi Chen, Jian He, Jasmin G John, Meiyun Lin, Pu Lin, Sergey Malyshev, David J Paynter, Elena Shevliakova, and Ming Zhao, October 2020: The GFDL Global Atmospheric Chemistry-Climate Model AM4.1: Model Description and Simulation Characteristics. *Journal of Advances in Modeling Earth Systems*, 12(10), DOI:10.1029/2019MS002032.
Abstract
50. Kuo, Yi-Hung, J David Neelin, C-C Chen, W-T Chen, Leo J Donner, Andrew Gettelman, Xianan Jiang, K-T Kuo, Eric Maloney, C R Mechoso, Yi Ming, K A Schiro, Charles J Seman, Chien-Ming Wu, and Ming Zhao, January 2020: Convective transition statistics over tropical oceans for climate model diagnostics: GCM evaluation. *Journal of the Atmospheric Sciences*, 77(1), DOI:10.1175/JAS-D-19-0132.1.
Abstract
51. Moon, Yumin, D Kim, Suzana J Camargo, Allison A Wing, Adam H Sobel, Hiroyuki Murakami, Kevin A Reed, Enrico Scoccimarro, Gabriel A Vecchi, Michael F Wehner, Colin M Zarzycki, and Ming Zhao, February 2020: Azimuthally averaged wind and thermodynamic structures of tropical cyclones in global climate models and their sensitivity to horizontal resolution. *Journal of Climate*, 33(4), DOI:10.1175/JCLI-D-19-0172.1.
Abstract
52. Moon, Yumin, D Kim, Suzana J Camargo, Allison A Wing, Kevin A Reed, Michael F Wehner, and Ming Zhao, June 2020: A new method to construct a horizontal resolution-dependent wind speed adjustment factor for tropical cyclones in global climate model simulations. *Geophysical Research Letters*, 47(11), DOI:10.1029/2020GL087528.
Abstract
53. Murakami, Hiroyuki, Thomas L Delworth, William F Cooke, Ming Zhao, Baoqiang Xiang, and Pang-Chi Hsu, May 2020: Detected climatic change in global distribution of tropical cyclones. *Proceedings of the National Academy of Sciences*, 117(20), DOI:10.1073/pnas.1922500117.
Abstract
54. Naud, C M., J Jeyaratnam, James F Booth, Ming Zhao, and Andrew Gettelman, January 2020: Evaluation of modeled precipitation in oceanic extratropical cyclones using IMERG. *Journal of Climate*, 33(1), DOI:10.1175/JCLI-D-19-0369.1.
Abstract
55. Orbe, Clara, L Van Roekel, A F Adames, A Dezfuli, John Fasullo, Peter J Gleckler, Jiwoo Lee, Wei Li, Larissa Nazarenko, Gavin A Schmidt, Kenneth R Sperber, and Ming Zhao, September 2020: Representation of Modes of Variability in 6 U.S. Climate Models. *Journal of Climate*, 33(17), DOI:10.1175/JCLI-D-19-0956.1.
Abstract

56. Paulot, Fabien, David J Paynter, Michael Winton, Paul Ginoux, Ming Zhao, and Larry W Horowitz, February 2020: Revisiting the impact of sea salt on climate sensitivity. *Geophysical Research Letters*, 47(3), DOI:10.1029/2019GL085601.
Abstract
57. Pu, Bing, Paul Ginoux, Huan Guo, N C Hsu, J Kimball, B Marticorena, Sergey Malyshev, Vaishali Naik, N T O'Neill, Carlos Pérez Garcia-Pando, J Paireau, J M Prospero, Elena Shevliakova, and Ming Zhao, January 2020: Retrieving the global distribution of threshold of wind erosion from satellite data and implementing it into the GFDL AM4.0/LM4.0 model. *Atmospheric Chemistry and Physics*, 20(1), DOI:10.5194/acp-20-55-2020.
Abstract
58. Schnell, Jordan L., Vaishali Naik, Larry W Horowitz, Fabien Paulot, Paul Ginoux, Ming Zhao, and Daniel E Horton, May 2020: Corrigendum to “Air quality impacts from the electrification of light-duty passenger vehicles in the United States” [Atmos. Environ. 208 (2019) 95–102]. *Atmospheric Environment*, 229, DOI:10.1016/j.atmosenv.2020.117487.
59. Wing, Allison A., Catherine L Stauffer, Tobias Becker, Kevin A Reed, Min-Seop Ahn, Nathan P Arnold, Sandrine Bony, Mark Branson, George H Bryan, Jean-Pierre Chaboureau, Stephan R de Roode, Kulkarni Gayatri, Cathy Hohenegger, I-Kuan Hu, Fredrik Jansson, Todd R Jones, Marat Khairoutdinov, Daehyun Kim, Zane K Martin, Shuhei Matsugishi, Brian Medeiros, Hiroaki Miura, Yumin Moon, Sebastian K Muller, Tomoki Ohno, Max Popp, Thara Prabhakaran, David A Randall, Rosimar Rios-Berrios, Nicolas Rochetin, Romain Roehrig, David M Romps, James H Ruppert Jr, Masaki Satoh, Levi G Silvers, Martin S Singh, Bjorn Stevens, Lorenzo Tomassini, Chiel C van Heerwaarden, Shuguang Wang, and Ming Zhao, September 2020: Clouds and Convective Self-Aggregation in a Multi-Model Ensemble of Radiative-Convective Equilibrium Simulations. *Journal of Advances in Modeling Earth Systems*, 12(9), DOI:10.1029/2020MS002138.
Abstract
60. Winton, Michael, Alistair Adcroft, John P Dunne, Isaac M Held, Elena Shevliakova, Ming Zhao, Huan Guo, William J Hurlin, John P Krasting, Thomas R Knutson, David J Paynter, Levi G Silvers, and Rong Zhang, January 2020: Climate Sensitivity of GFDL's CM4.0. *Journal of Advances in Modeling Earth Systems*, 12(1), DOI:10.1029/2019MS001838.
Abstract
61. Yin, Jianjun, Stephen M Griffies, Michael Winton, Ming Zhao, and Laure Zanna, May 2020: Response of Storm-related Extreme Sea Level along the US Atlantic Coast to Combined Weather and Climate Forcing. *Journal of Climate*, 33(9), DOI:10.1175/JCLI-D-19-0551.1.
Abstract
62. Zhao, Ming, December 2020: Simulations of Atmospheric Rivers, Their Variability and Response to GlobalWarming Using GFDL’s New High Resolution General Circulation Model. *Journal of Climate*, 33(23), DOI:10.1175/JCLI-D-20-0241.1.
Abstract
63. Fan, Songmiao, Paul Ginoux, Charles J Seman, Levi G Silvers, and Ming Zhao, November 2019: Toward Improved Cloud-Phase Simulation with a Mineral Dust and Temperature-Dependent Parameterization for Ice Nucleation in Mixed-Phase Clouds. *Journal of the Atmospheric Sciences*, 76(11), DOI:10.1175/JAS-D-18-0287.1.
Abstract
64. Held, Isaac M., Huan Guo, Alistair Adcroft, John P Dunne, Larry W Horowitz, John P Krasting, Elena Shevliakova, Michael Winton, Ming Zhao, Mitchell Bushuk, Andrew T Wittenberg, Bruce Wyman, Baoqiang Xiang, Rong Zhang, Whit G Anderson, V Balaji, Leo J Donner, Krista A Dunne, Jeffrey W Durachta, Paul P G Gauthier, Paul Ginoux, Jean-Christophe Golaz, Stephen M Griffies, Robert Hallberg, Lucas Harris, Matthew J Harrison, William J Hurlin, Jasmin G John, Pu Lin,

Shian-Jiann Lin, Sergey Malyshev, Raymond Menzel, P C D Milly, Yi Ming, Vaishali Naik, David J Paynter, Fabien Paulot, V Ramaswamy, Brandon G Reichl, Thomas E Robinson, Anthony Rosati, Charles J Seman, Levi G Silvers, Seth D Underwood, and Niki Zadeh, November 2019: Structure and Performance of GFDL's CM4.0 Climate Model. *Journal of Advances in Modeling Earth Systems*, 11(11), DOI:10.1029/2019MS001829.
Abstract

65. Maloney, Eric, Andrew Gettelman, Yi Ming, J David Neelin, D Barrie, Annarita Mariotti, C-C Chen, D B Coleman, Yi-Hung Kuo, B Singh, H Annamalai, Alexis Berg, James F Booth, Suzana J Camargo, A Dai, A Gonzalez, J Hafner, Xianan Jiang, X Jing, D Kim, Arun Kumar, Yumin Moon, C M Naud, Adam H Sobel, K Suzuki, F Wang, J Wang, Allison A Wing, X Xu, and Ming Zhao, September 2019: Process-Oriented Evaluation of Climate and Weather Forecasting Models. *Bulletin of the American Meteorological Society*, 100(9), DOI:10.1175/BAMS-D-18-0042.1.
Abstract
66. Naud, C M., James F Booth, J Jeyaratnam, Leo J Donner, Charles J Seman, Ming Zhao, Huan Guo, and Yi Ming, October 2019: Extratropical Cyclone Clouds in the GFDL climate model: diagnosing biases and the associated causes. *Journal of Climate*, 32(20), DOI:10.1175/JCLI-D-19-0421.1.
Abstract
67. Schnell, Jordan L., Vaishali Naik, Larry W Horowitz, Fabien Paulot, Paul Ginoux, Ming Zhao, and Daniel E Horton, July 2019: Air quality impacts from the electrification of light-duty passenger vehicles in the United States. *Atmospheric Environment*, 208, DOI:10.1016/j.atmosenv.2019.04.003.
Abstract
68. Shin, Hyeyum H., Yi Ming, Ming Zhao, Xi Chen, and Shian-Jiann Lin, April 2019: Improved Surface Layer Simulation Using Refined Vertical Resolution in the GFDL Atmospheric General Circulation Model. *Journal of Advances in Modeling Earth Systems*, 11(4), DOI:10.1029/2018MS001437.
Abstract
69. Wing, Allison A., Suzana J Camargo, Adam H Sobel, D Kim, Yumin Moon, Hiroyuki Murakami, Kevin A Reed, Gabriel A Vecchi, Michael F Wehner, Colin M Zarzycki, and Ming Zhao, September 2019: Moist static energy budget analysis of tropical cyclone intensification in high-resolution climate models. *Journal of Climate*, 32(18), DOI:10.1175/JCLI-D-18-0599.1.
Abstract
70. Xiang, Baoqiang, Shian-Jiann Lin, Ming Zhao, Nathaniel C Johnson, Xiaosong Yang, and Xianan Jiang, January 2019: Subseasonal Week 3-5 Surface Air Temperature Prediction during Boreal Wintertime in a GFDL model. *Geophysical Research Letters*, 46(1), DOI:10.1029/2018GL081314.
Abstract
71. Zhou, W, Ming Zhao, and Da Yang, June 2019: Understand the direct effect of CO2 increase on tropical circulation and TC activity: land surface warming versus direct radiative forcing. *Geophysical Research Letters*, 46(12), DOI:10.1029/2019GL082865.
Abstract
72. Zhu, Y, Tim Li, Ming Zhao, and Tomoe Nasuno, July 2019: Interaction between MJO and High Frequency Waves over Maritime Continent in Boreal Winter. *Journal of Climate*, 32(13), DOI:10.1175/JCLI-D-18-0511.1.
Abstract
73. Hill, Spencer A., Yi Ming, and Ming Zhao, December 2018: Robust responses of the Sahelian hydrological cycle to global warming. *Journal of Climate*, 31(24), DOI:10.1175/JCLI-D-18-0238.1.
Abstract
74. Jiang, Xianan, A F Adames, Ming Zhao, D E Waliser, and Eric Maloney, June 2018: A Unified Moisture Mode Framework for Seasonality of the Madden-Julian Oscillation. *Journal of Climate*,

31(11), DOI:10.1175/JCLI-D-17-0671.1.
Abstract
75. Jiang, Xianan, Baoqiang Xiang, Ming Zhao, Tim Li, Shian-Jiann Lin, Z Wang, and Jan-Huey Chen, August 2018: Intraseasonal Tropical Cyclogenesis Prediction in a Global Coupled Model System. *Journal of Climate*, 31(15), DOI:10.1175/JCLI-D-17-0454.1.
Abstract
76. Kim, D, Yumin Moon, Suzana J Camargo, Allison A Wing, Adam H Sobel, Hiroyuki Murakami, Gabriel A Vecchi, Ming Zhao, and E Page, March 2018: Process-oriented diagnosis of tropical cyclones in high-resolution GCMs. *Journal of Climate*, 31(5), DOI:10.1175/JCLI-D-17-0269.1.
Abstract
77. Li, Shan, Shaoqing Zhang, Zhengyu Liu, Lv Lu, J Zhu, X-F Zhang, Xinrong Wu, Ming Zhao, and Gabriel A Vecchi, et al., April 2018: Estimating Convection Parameters in the GFDL CM2.1 Model Using Ensemble Data Assimilation. *Journal of Advances in Modeling Earth Systems*, 10(4), DOI:10.1002/2017MS001222.
Abstract
78. Li, Weiwei, Z Wang, Gan Zhang, M S Peng, S G Benjamin, and Ming Zhao, December 2018: Subseasonal Variability of Rossby Wave Breaking and Impacts on Tropical Cyclones during the North Atlantic Warm Season. *Journal of Climate*, 31(23), DOI:10.1175/JCLI-D-17-0880.1.
Abstract
79. Schnell, Jordan L., Vaishali Naik, Larry W Horowitz, Fabien Paulot, Jingqiu Mao, Paul Ginoux, Ming Zhao, and K Ram, July 2018: Exploring the relationship between surface PM2.5 and meteorology in Northern India. *Atmospheric Chemistry and Physics*, 18(14), DOI:10.5194/acp-18-10157-2018.
Abstract
80. Shin, Hyeyum H., Yi Ming, Ming Zhao, Jean-Christophe Golaz, Baoqiang Xiang, and Huan Guo, July 2018: Evaluation of Planetary Boundary Layer Simulation in GFDL Atmospheric General Circulation Models. *Journal of Climate*, 31(13), DOI:10.1175/JCLI-D-17-0543.1.
Abstract
81. Silvers, Levi G., David J Paynter, and Ming Zhao, January 2018: The Diversity of Cloud Responses to Twentieth Century Sea Surface Temperatures. *Geophysical Research Letters*, 45(1), DOI:10.1002/2017GL075583.
Abstract
82. Xiang, Baoqiang, Ming Zhao, and Yi Ming, et al., July 2018: Contrasting Impacts of radiative forcing in the Southern Ocean versus Southern Tropics on ITCZ position and energy transport in one GFDL climate model. *Journal of Climate*, 31(14), DOI:10.1175/JCLI-D-17-0566.1.
Abstract
83. Zhao, Ming, Jean-Christophe Golaz, Isaac M Held, Huan Guo, V Balaji, Rusty Benson, Jan-Huey Chen, Xi Chen, Leo J Donner, John P Dunne, Krista A Dunne, Jeffrey W Durachta, Songmiao Fan, Stuart Freidenreich, Stephen T Garner, Paul Ginoux, Lucas Harris, Larry W Horowitz, John P Krasting, Amy R Langenhorst, Zhi Liang, Pu Lin, Shian-Jiann Lin, Sergey Malyshev, E Mason, P C D Milly, Yi Ming, Vaishali Naik, Fabien Paulot, David J Paynter, Peter Phillipps, Aparna Radhakrishnan, V Ramaswamy, Thomas E Robinson, M Daniel Schwarzkopf, Charles J Seman, Elena Shevliakova, Zhaoyi Shen, Hyeyum Hailey Shin, Levi G Silvers, R John Wilson, Michael Winton, Andrew T Wittenberg, Bruce Wyman, and Baoqiang Xiang, March 2018: The GFDL Global Atmosphere and Land Model AM4.0/LM4.0 - Part I: Simulation Characteristics with Prescribed SSTs. *Journal of Advances in Modeling Earth Systems*, 10(3), DOI:10.1002/2017MS001208.
Abstract

84. Zhao, Ming, Jean-Christophe Golaz, Isaac M Held, Huan Guo, V Balaji, Rusty Benson, Jan-Huey Chen, Xi Chen, Leo J Donner, John P Dunne, Krista A Dunne, Jeffrey W Durachta, Songmiao Fan, Stuart Freidenreich, Stephen T Garner, Paul Ginoux, Lucas Harris, Larry W Horowitz, John P Krasting, Amy R Langenhorst, Zhi Liang, Pu Lin, Shian-Jiann Lin, Sergey Malyshev, E Mason, P C D Milly, Yi Ming, Vaishali Naik, Fabien Paulot, David J Paynter, Peter Phillipps, Aparna Radhakrishnan, V Ramaswamy, Thomas E Robinson, M Daniel Schwarzkopf, Charles J Seman, Elena Shevliakova, Zhaoyi Shen, Hyeyum Hailey Shin, Levi G Silvers, R John Wilson, Michael Winton, Andrew T Wittenberg, Bruce Wyman, and Baoqiang Xiang, March 2018: The GFDL Global Atmosphere and Land Model AM4.0/LM4.0 - Part II: Model Description, Sensitivity Studies, and Tuning Strategies. *Journal of Advances in Modeling Earth Systems*, 10(3), DOI:10.1002/2017MS001209.
Abstract
85. Dogar, Muhammad M., Georgiy Stenchikov, Sergey Osipov, Bruce Wyman, and Ming Zhao, August 2017: Sensitivity of the Regional Climate in the Middle East and North Africa to Volcanic perturbations. *Journal of Geophysical Research: Atmospheres*, 122(15), DOI:10.1002/2017JD026783.
Abstract
86. Gao, Kun, Jan-Huey Chen, Lucas Harris, Shian-Jiann Lin, Baoqiang Xiang, and Ming Zhao, December 2017: Impact of Intraseasonal Oscillations on the Tropical Cyclone Activity over the Gulf of Mexico and Western Caribbean Sea in GFDL HiRAM. *Journal of Geophysical Research: Atmospheres*, 122(24), DOI:10.1002/2017JD027756.
Abstract
87. Hill, Spencer A., Yi Ming, Isaac M Held, and Ming Zhao, August 2017: A moist static energy budget-based analysis of the Sahel rainfall response to uniform oceanic warming. *Journal of Climate*, 30(15), DOI:10.1175/JCLI-D-16-0785.1.
Abstract
88. Nakamura, J, Suzana J Camargo, Adam H Sobel, N Henderson, Kerry A Emanuel, Arun Kumar, T LaRow, Hiroyuki Murakami, Malcolm J Roberts, Enrico Scoccimarro, Pier Luigi Vidale, H Wang, Michael F Wehner, and Ming Zhao, September 2017: Western North Pacific tropical cyclone model tracks in present and future climates. *Journal of Geophysical Research: Atmospheres*, 122(18), DOI:10.1002/2017JD027007.
Abstract
89. Xiang, Baoqiang, Ming Zhao, Isaac M Held, and Jean-Christophe Golaz, February 2017: Predicting the severity of spurious “double ITCZ” problem in CMIP5 coupled models from AMIP simulations. *Geophysical Research Letters*, 44(3), DOI:10.1002/2016GL071992.
Abstract
90. Han, R, H Wang, Zeng-Zhen Hu, Arun Kumar, W Li, L Long, J-K E Schemm, P Peng, Wanqui Wang, D Si, X Jia, Ming Zhao, and Gabriel A Vecchi, et al., September 2016: An assessment of multi-model simulations for the variability of western North Pacific tropical cyclones and its association with ENSO. *Journal of Climate*, 29(18), DOI:10.1175/JCLI-D-15-0720.1.
Abstract
91. Jiang, Xianan, and Ming Zhao, et al., October 2016: Convective Moisture Adjustment Time-scale as a Key Factor in Regulating Model Amplitude of the Madden-Julian Oscillation. *Geophysical Research Letters*, 43(19), DOI:10.1002/2016GL070898.
Abstract
92. Li, Shan, Shaoqing Zhang, Zhengyu Liu, Xiaosong Yang, Anthony Rosati, Jean-Christophe Golaz, and Ming Zhao, June 2016: The Role of Large-scale Feedbacks in Cumulus Convection Parameter

Estimation. *Journal of Climate*, 29(11), DOI:10.1175/JCLI-D-15-0117.1.
Abstract

93. Merlis, Timothy M., W Zhou, Isaac M Held, and Ming Zhao, March 2016: Surface temperature dependence of tropical cyclone-permitting simulations in a spherical model with uniform thermal forcing. *Geophysical Research Letters*, 43(6), DOI:10.1002/2016GL067730.
Abstract
94. Strazzo, S E., J B Elsner, T LaRow, Hiroyuki Murakami, Michael F Wehner, and Ming Zhao, September 2016: The influence of model resolution on the simulated sensitivity of North Atlantic tropical cyclone maximum intensity to sea surface temperature. *Journal of Advances in Modeling Earth Systems*, 8(3), DOI:10.1002/2016MS000635.
Abstract
95. Zhao, Ming, Jean-Christophe Golaz, Isaac M Held, V Ramaswamy, Shian-Jiann Lin, Yi Ming, Paul Ginoux, Bruce Wyman, Leo J Donner, David J Paynter, and Huan Guo, January 2016: Uncertainty in model climate sensitivity traced to representations of cumulus precipitation microphysics. *Journal of Climate*, DOI:10.1175/JCLI-D-15-0191.1.
Abstract
96. Ballinger, Andrew, Timothy M Merlis, Isaac M Held, and Ming Zhao, June 2015: The sensitivity of tropical cyclone activity to off-equatorial thermal forcing in aquaplanet simulations. *Journal of the Atmospheric Sciences*, 72(6), DOI:10.1175/JAS-D-14-0284.1.
Abstract
97. Daloz, A S., Suzana J Camargo, James Kossin, Kerry A Emanuel, M Horn, J A Jonas, D Kim, T LaRow, Y-K Kim, Christina M Patricola, Malcolm J Roberts, Enrico Scoccimarro, D Shaevitz, Pier Luigi Vidale, H Wang, Michael F Wehner, and Ming Zhao, February 2015: Cluster analysis of downscaled and explicitly simulated North Atlantic tropical cyclone tracks. *Journal of Climate*, 28(4), DOI:10.1175/JCLI-D-13-00646.1.
Abstract
98. Dwyer, John, Suzana J Camargo, Adam H Sobel, M Biasutti, Kerry A Emanuel, Gabriel A Vecchi, Ming Zhao, and Michael K Tippett, August 2015: Projected Twenty-First-Century Changes in the Length of the Tropical Cyclone Season. *Journal of Climate*, 28(15), DOI:10.1175/JCLI-D-14-00686.1.
Abstract
99. Guo, Huan, Jean-Christophe Golaz, Leo J Donner, Bruce Wyman, Ming Zhao, and Paul Ginoux, June 2015: CLUBB as a unified cloud parameterization: opportunities and challenges. *Geophysical Research Letters*, 42(11), DOI:10.1002/2015GL063672.
Abstract
100. Knutson, Thomas R., Joseph J Sirutis, Ming Zhao, Robert E Tuleya, Morris A Bender, Gabriel A Vecchi, Gabriele Villarini, and Daniel Chavas, September 2015: Global Projections of Intense Tropical Cyclone Activity for the Late Twenty-First Century from Dynamical Downscaling of CMIP5/RCP4.5 Scenarios. *Journal of Climate*, 28(18), DOI:10.1175/JCLI-D-15-0129.1.
Abstract
101. Lin, Yanluan, Ming Zhao, and M Zhang, March 2015: Tropical cyclone rainfall area controlled by relative sea surface temperature. *Nature Communications*, 6, 6591, DOI:10.1038/ncomms7591.
Abstract
102. Mei, W, Shang-Ping Xie, Ming Zhao, and Yan Wang, January 2015: Forced and internal variability of tropical cyclone track density in the western North Pacific. *Journal of Climate*, 28(1), DOI:10.1175/JCLI-D-14-00164.1.
Abstract

103. Walsh, Kevin J., Suzana J Camargo, Gabriel A Vecchi, A S Daloz, J B Elsner, Kerry A Emanuel, M Horn, Y-K Lim, Malcolm J Roberts, Christina M Patricola, Enrico Scoccimarro, Adam H Sobel, S E Strazzo, Gabriele Villarini, Michael F Wehner, Ming Zhao, James Kossin, T LaRow, K Oouchi, S D Schubert, H Wang, Julio T Bacmeister, Ping Chang, F Chauvin, Christiane Jablonowski, Arun Kumar, and Hiroyuki Murakami, et al., July 2015: Hurricanes and climate: the U.S. CLIVAR working group on hurricanes. *Bulletin of the American Meteorological Society*, 96(6), DOI:10.1175/BAMS-D-13-00242.1.
Abstract

104. Webb, M J., Adrian P Lock, Christopher S Bretherton, Sandrine Bony, Jason N S Cole, A Idelkadi, Sarah M Kang, T Koshiro, H Kawai, T Ogura, Romain Roehrig, Yechul Shin, T Mauritsen, S C Sherwood, J Vial, M Watanabe, M D Woelfle, and Ming Zhao, October 2015: The impact of parametrized convection on cloud feedback. *Philosophical Transactions of the Royal Society of London, A*, 373, DOI:10.1098/rsta.2014.0414.
Abstract

105. Xiang, Baoqiang, Shian-Jiann Lin, Ming Zhao, Gabriel A Vecchi, Tim Li, Xianan Jiang, Lucas Harris, and Jan-Huey Chen, February 2015: Beyond weather time scale prediction for Hurricane Sandy and Super Typhoon Haiyan in a global climate model. *Monthly Weather Review*, 143(2), DOI:10.1175/MWR-D-14-00227.1.
Abstract

106. Xiang, Baoqiang, Ming Zhao, Xianan Jiang, Shian-Jiann Lin, Tim Li, X Fu, and Gabriel A Vecchi, July 2015: The 3-4 Week MJO Prediction Skill in a GFDL Coupled Model. *Journal of Climate*, 28(13), DOI:10.1175/JCLI-D-15-0102.1.
Abstract

107. Zhang, Shaoqing, Ming Zhao, Shian-Jiann Lin, Xiaosong Yang, Whit G Anderson, Anthony Rosati, Seth D Underwood, and Fanrong Zeng, July 2015: Impact of Having Realistic Tropical Cyclone Frequency on Ocean Heat Content and Transport Forecasts in a High-Resolution Coupled Model. *Geophysical Research Letters*, 42(14), DOI:10.1002/2015GL064745.
Abstract

108. Camargo, Suzana J., Michael K Tippett, Adam H Sobel, Gabriel A Vecchi, and Ming Zhao, December 2014: Testing the performance of tropical cyclone genesis indices in future climates using the HIRAM model. *Journal of Climate*, 27(24), DOI:10.1175/JCLI-D-13-00505.1.
Abstract

109. Flannaghan, Thomas J., Stephan Fueglistaler, Isaac M Held, S Po-Chedley, Bruce Wyman, and Ming Zhao, December 2014: Tropical temperature trends in Atmospheric General Circulation Model simulations and the impact of uncertainties in observed SSTs. *Journal of Geophysical Research: Atmospheres*, 119(23), DOI:10.1002/2014JD022365.
Abstract

110. Horn, M, Kevin J E Walsh, Ming Zhao, Suzana J Camargo, Enrico Scoccimarro, Hiroyuki Murakami, H Wang, and Andrew Ballinger, et al., December 2014: Tracking Scheme Dependence of Simulated Tropical Cyclone Response to Idealized Climate Simulations. *Journal of Climate*, 27(24), DOI:10.1175/JCLI-D-14-00200.1.
Abstract

111. Kim, Hyeong-Seog, Gabriel A Vecchi, Thomas R Knutson, Whit G Anderson, Thomas L Delworth, Anthony Rosati, Fanrong Zeng, and Ming Zhao, November 2014: Tropical Cyclone Simulation and Response to CO2 Doubling in the GFDL CM2.5 High-Resolution Coupled Climate Model. *Journal of Climate*, 27(21), DOI:10.1175/JCLI-D-13-00475.1.
Abstract

112. Knutson, Thomas R., Fanrong Zeng, Andrew T Wittenberg, Hyeong-Seog Kim, Joseph J Sirutis, Morris A Bender, Ming Zhao, and Robert E Tuleya, January 2014: Recent Research at GFDL on Surface Temperature Trends and Simulations of Tropical Cyclone Activity in the Indian Ocean Region In *Monitoring and Prediction of Tropical Cyclones in the Indian Ocean and Climate Change*, New Delhi, India, Springer, DOI:10.1007/978-94-007-7720-0_5.
Abstract
113. Maloney, Eric, Suzana J Camargo, E K M Chang, Brian A Colle, R Fu, K L Geil, Qi Hu, Xianan Jiang, Nathaniel C Johnson, K B Karnauskas, J L Kinter, Ben P Kirtman, Sanjiv Kumar, B Langenbrunner, K Lombardo, L Long, Annarita Mariotti, J E Meyerson, K Mo, J David Neelin, Zaitao Pan, Richard Seager, Yolande L Serra, A Seth, Justin Sheffield, Julienne Stroeve, J Thibeault, Shang-Ping Xie, Chunzai Wang, Bruce Wyman, and Ming Zhao, March 2014: North American Climate in CMIP5 Experiments: Part III: Assessment of 21st Century Projections. *Journal of Climate*, 27(6), DOI:10.1175/JCLI-D-13-00273.1.
Abstract
114. Mei, W, Shang-Ping Xie, and Ming Zhao, July 2014: Variability of Tropical Cyclone Track Density in the North Atlantic: Observations and High-Resolution Simulations. *Journal of Climate*, 27(13), DOI:10.1175/JCLI-D-13-00587.1.
Abstract
115. Scoccimarro, Enrico, Silvio Gualdi, Gabriele Villarini, Gabriel A Vecchi, and Ming Zhao, et al., June 2014: Intense Precipitation Events Associated with Landfalling Tropical Cyclones in response to a Warmer Climate and increased CO2. *Journal of Climate*, 27(12), DOI:10.1175/JCLI-D-14-00065.1.
Abstract
116. Shaevitz, D, Suzana J Camargo, Adam H Sobel, J A Jonas, D Kim, Arun Kumar, T LaRow, Y-K Lim, Hiroyuki Murakami, Kevin A Reed, Malcolm J Roberts, Enrico Scoccimarro, Pier Luigi Vidale, H Wang, Michael F Wehner, Ming Zhao, and N Henderson, December 2014: Characteristics of tropical cyclones in high-resolution models in the present climate. *Journal of Advances in Modeling Earth Systems*, 6(4), DOI:10.1002/2014MS000372.
Abstract
117. Villarini, Gabriele, D A Lavers, Enrico Scoccimarro, Ming Zhao, Michael F Wehner, Gabriel A Vecchi, Thomas R Knutson, and Kevin A Reed, June 2014: Sensitivity of Tropical Cyclone Rainfall to Idealized Global Scale Forcings. *Journal of Climate*, 27(12), DOI:10.1175/JCLI-D-13-00780.1.
Abstract
118. Wang, H, L Long, Arun Kumar, Wanqui Wang, J-K E Shemm, Ming Zhao, and Gabriel A Vecchi, et al., August 2014: How well do global climate models simulate the variability of Atlantic tropical cyclones associated with ENSO? *Journal of Climate*, 27(15), DOI:10.1175/JCLI-D-13-00625.1.
Abstract
119. Xiang, Baoqiang, Bin Wang, J Li, Ming Zhao, and June-Yi Lee, November 2014: Understanding the anthropogenically forced change of equatorial Pacific trade winds in coupled climate models. *Journal of Climate*, 27(22), DOI:10.1175/JCLI-D-14-00115.1.
Abstract
120. Zhang, Shaoqing, Ming Zhao, Shian-Jiann Lin, Xiaosong Yang, and Whit G Anderson, January 2014: Retrieval of Tropical Cyclone Statistics with a High-Resolution Coupled Model and Data. *Geophysical Research Letters*, 41(2), DOI:10.1002/2013GL058879.
Abstract
121. Zhao, Ming, March 2014: An Investigation of the Connections among Convection, Clouds, and Climate Sensitivity in a Global Climate Model. *Journal of Climate*, 27(5),

DOI:10.1175/JCLI-D-13-00145.1.
Abstract
122. Blackburn, M, Ming Zhao, and Isaac M Held, et al., October 2013: The Aqua Planet Experiment (APE): CONTROL SST Simulation. *Journal of the Meteorological Society of Japan*, 91A, DOI:10.2151/jmsj.2013-A02.
Abstract
123. Elsner, J B., S E Strazzo, T H Jagger, T LaRow, and Ming Zhao, August 2013: Sensitivity of limiting hurricane intensity to SST in the Atlantic from observations and GCMs. *Journal of Climate*, 26(16), DOI:10.1175/JCLI-D-12-00433.1.
Abstract
124. Knutson, Thomas R., Joseph J Sirutis, Gabriel A Vecchi, Stephen T Garner, Ming Zhao, Hyeong-Seog Kim, Morris A Bender, Robert E Tuleya, Isaac M Held, and Gabriele Villarini, September 2013: Dynamical downscaling projections of 21st century Atlantic hurricane activity: CMIP3 and CMIP5 model-based scenario. *Journal of Climate*, 26(17), DOI:10.1175/JCLI-D-12-00539.1.
Abstract
125. Lin, Yanluan, Ming Zhao, Yi Ming, Jean-Christophe Golaz, Leo J Donner, Stephen A Klein, V Ramaswamy, and Shang-Ping Xie, August 2013: Precipitation partitioning, tropical clouds and intraseasonal variability in GFDL AM2. *Journal of Climate*, 26(15), DOI:10.1175/JCLI-D-12-00442.1.
Abstract
126. Merlis, Timothy M., Ming Zhao, and Isaac M Held, August 2013: The sensitivity of hurricane frequency to ITCZ changes and radiatively forced warming in aquaplanet simulations. *Geophysical Research Letters*, 40(15), DOI:10.1002/grl.50680.
Abstract
127. Sheffield, Justin, Suzana J Camargo, R Fu, Qi Hu, Xianan Jiang, Nathaniel C Johnson, K B Karnauskas, Seon Tae Kim, J L Kinter, Sanjiv Kumar, B Langenbrunner, Eric Maloney, Annarita Mariotti, J E Meyerson, J David Neelin, S Nigam, Zaitao Pan, A Ruiz-Barradas, Richard Seager, Yolande L Serra, D-Z Sun, Chunzai Wang, Shang-Ping Xie, J-Y Yu, Tao Zhang, and Ming Zhao, December 2013: North American Climate in CMIP5 Experiments. Part II: Evaluation of Historical Simulations of Intra-Seasonal to Decadal Variability. *Journal of Climate*, 26(23), DOI:10.1175/JCLI-D-12-00593.1.
Abstract
128. Strazzo, S E., J B Elsner, T LaRow, D J Halperin, and Ming Zhao, November 2013: Observed versus GCM-generated local tropical cyclone frequency: Comparisons using a spatial lattice. *Journal of Climate*, 26(21), DOI:10.1175/JCLI-D-12-00808.1.
Abstract
129. Vecchi, Gabriel A., Stephan Fueglistaler, Isaac M Held, Thomas R Knutson, and Ming Zhao, June 2013: Impacts of atmospheric temperature trends on tropical cyclone activity. *Journal of Climate*, 26(11), DOI:10.1175/JCLI-D-12-00503.1.
Abstract
130. Williamson, D L., Ming Zhao, and Isaac M Held, et al., October 2013: The Aqua Planet Experiment (APE): Response to Changed Meridional SST Profile. *Journal of the Meteorological Society of Japan*, 91A, DOI:10.2151/jmsj.2013-A03.
Abstract
131. Zhang, M, Jean-Christophe Golaz, and Ming Zhao, et al., December 2013: CGILS: Results from the first phase of an international project to understand the physical mechanisms of low cloud feedbacks in single column models. *Journal of Advances in Modeling Earth Systems*, 5(4),

DOI:10.1002/2013MS000246.
Abstract

132. Ginoux, Paul, J M Prospero, T E Gill, C Hsu, and Ming Zhao, August 2012: Global scale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products. *Reviews of Geophysics*, 50, RG3005, DOI:10.1029/2012RG000388.
Abstract

133. Hsu, P, Tim Li, J-J Luo, Hiroyuki Murakami, A Kitoh, and Ming Zhao, March 2012: Increase of global monsoon area and precipitation under global warming: A robust signal? *Geophysical Research Letters*, 39, L06701, DOI:10.1029/2012GL051037.
Abstract

134. Jiang, Xianan, Ming Zhao, and D E Waliser, October 2012: Modulation of tropical cyclones over the Eastern Pacific by the intra-seasonal variability simulated in an AGCM. *Journal of Climate*, 25(19), DOI:10.1175/JCLI-D-11-00531.1.
Abstract

135. Jiang, Xianan, D E Waliser, D Kim, Ming Zhao, Kenneth R Sperber, and William F Stern, et al., August 2012: Simulation of the intraseasonal variability over the Eastern Pacific ITCZ in climate models. *Climate Dynamics*, 39(3-4), DOI:10.1007/s00382-011-1098-x.
Abstract

136. Lin, Yanluan, Leo J Donner, Stephen A Klein, and Ming Zhao, et al., May 2012: TWP-ICE global atmospheric model intercomparison: convection responsiveness and resolution impact. *Journal of Geophysical Research: Atmospheres*, 117, D09111, DOI:10.1029/2011JD017018.
Abstract

137. Williamson, D L., M Blackburn, B J Hoskins, Ming Zhao, and Isaac M Held, et al., 2012: In *The APE Atlas*, NCAR Technical Note NCAR/TN-484+STR, Boulder, Colorado, National Center for Atmospheric Research, DOI:10.5065/D6FF3QBR.

138. Zhao, Ming, and Isaac M Held, April 2012: TC-permitting GCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. *Journal of Climate*, 25(8), DOI:10.1175/JCLI-D-11-00313.1.
Abstract

139. Zhao, Ming, Isaac M Held, and Shian-Jiann Lin, July 2012: Some counter-intuitive dependencies of tropical cyclone frequency on parameters in a GCM. *Journal of the Atmospheric Sciences*, 69(7), DOI:10.1175/JAS-D-11-0238.1.
Abstract

140. Donner, Leo J., Bruce Wyman, Richard S Hemler, Larry W Horowitz, Yi Ming, Ming Zhao, Jean-Christophe Golaz, Paul Ginoux, Shian-Jiann Lin, M Daniel Schwarzkopf, John Austin, Ghassan Alaka, William F Cooke, Thomas L Delworth, Stuart Freidenreich, C Tony Gordon, Stephen M Griffies, Isaac M Held, William J Hurlin, Stephen A Klein, Thomas R Knutson, Amy R Langenhorst, Hyun-Chul Lee, Yanluan Lin, B I Magi, Sergey Malyshev, P C D Milly, Vaishali Naik, Mary Jo Nath, Robert Pincus, Jeff J Ploshay, V Ramaswamy, Charles J Seman, Elena Shevliakova, Joseph J Sirutis, William F Stern, Ronald J Stouffer, R John Wilson, Michael Winton, Andrew T Wittenberg, and Fanrong Zeng, July 2011: The dynamical core, physical parameterizations, and basic simulation characteristics of the atmospheric component AM3 of the GFDL Global Coupled Model CM3. *Journal of Climate*, 24(13), DOI:10.1175/2011JCLI3955.1.
Abstract

141. Golaz, Jean-Christophe, M Salzmann, Leo J Donner, Larry W Horowitz, Yi Ming, and Ming Zhao, July 2011: Sensitivity of the aerosol indirect effect to subgrid variability in the cloud parameterization of the GFDL Atmosphere General Circulation Model AM3. *Journal of Climate*,

24(13), DOI:10.1175/2010JCLI3945.1.
Abstract
142. Held, Isaac M., and Ming Zhao, October 2011: The response of tropical cyclone statistics to an increase in CO2 with fixed sea surface temperatures. *Journal of Climate*, 24(20), DOI:10.1175/JCLI-D-11-00050.1.
Abstract
143. Kahn, B H., João Teixeira, E J Fetzer, Andrew Gettelman, S M Hristova-Veleva, X Huang, A K Kochanski, M Köhler, S K Krueger, R Wood, and Ming Zhao, September 2011: Temperature and water vapor variance scaling in global models: Comparisons to satellite and aircraft data. *Journal of the Atmospheric Sciences*, 68(9), DOI:10.1175/2011JAS3737.1.
Abstract
144. Teixeira, João, and Ming Zhao, et al., October 2011: Tropical and sub-tropical cloud transitions in weather and climate prediction models: the GCSS/WGNE Pacific Crosssection Intercomparison (GPCI). *Journal of Climate*, 24(20), DOI:10.1175/2011JCLI3672.1.
Abstract
145. Vecchi, Gabriel A., Ming Zhao, H Wang, Gabriele Villarini, Anthony Rosati, Arun Kumar, Isaac M Held, and Richard G Gudgel, April 2011: Statistical-dynamical predictions of seasonal North Atlantic hurricane activity. *Monthly Weather Review*, 139(4), DOI:10.1175/2010MWR3499.1.
Abstract
146. Villarini, Gabriele, Gabriel A Vecchi, Thomas R Knutson, Ming Zhao, and James A Smith, July 2011: North Atlantic tropical storm frequency response to anthropogenic forcing: Projections and sources of uncertainty. *Journal of Climate*, 24(13), DOI:10.1175/2011JCLI3853.1.
Abstract
147. Li, Tim, Minho Kwon, and Ming Zhao, et al., November 2010: Global warming shifts Pacific tropical cyclone location. *Geophysical Research Letters*, 37, L21804, DOI:10.1029/2010GL045124.
Abstract
148. Zhao, Ming, Isaac M Held, and Gabriel A Vecchi, October 2010: Retrospective forecasts of the hurricane season using a global atmospheric model assuming persistence of SST anomalies. *Monthly Weather Review*, 138(10), DOI:10.1175/2010MWR3366.1.
Abstract
149. Zhao, Ming, and Isaac M Held, December 2010: An analysis of the effect of global warming on the intensity of Atlantic hurricanes using a GCM with statistical refinement. *Journal of Climate*, 23(23), DOI:10.1175/2010JCLI3837.1.
Abstract
150. Mapes, B E., Julio T Bacmeister, Marat Khairoutdinov, Cecile Hannay, and Ming Zhao, January 2009: Virtual field campaigns on deep tropical convection in climate models. *Journal of Climate*, 22(2), DOI:10.1175/2008JCLI2203.1.
Abstract
151. Zhao, Ming, Isaac M Held, Shian-Jiann Lin, and Gabriel A Vecchi, December 2009: Simulations of global hurricane climatology, interannual variability, and response to global warming using a 50km resolution GCM. *Journal of Climate*, 22(24), DOI:10.1175/2009JCLI3049.1.
Abstract
152. Held, Isaac M., and Ming Zhao, June 2008: Horizontally homogeneous rotating radiative–convective Equilibria at GCM resolution. *Journal of the Atmospheric Sciences*, 65(6), DOI:10.1175/2007JAS2604.1.
Abstract
153. Kang, Sarah M., Isaac M Held, D M W Frierson, and Ming Zhao, 2008: The response of the ITCZ to extratropical thermal forcing: Idealized slab-ocean experiments with a GCM. *Journal of*

Climate, 21(14), DOI:10.1175/2007JCLI2146.1.
Abstract

154. Medeiros, Brian, Bjorn Stevens, Isaac M Held, Ming Zhao, D L Williamson, J Olson, and Christopher S Bretherton, October 2008: Aquaplanets, climate sensitivity, and low clouds. *Journal of Climate*, 21(19), DOI:10.1175/2008JCLI1995.1.
Abstract
155. Held, Isaac M., Ming Zhao, and Bruce Wyman, January 2007: Dynamic radiative-convective equilibria using GCM column physics. *Journal of the Atmospheric Sciences*, 64(1), 228-238.
Abstract PDF
156. Wyant, M C., and Ming Zhao, et al., December 2007: A single-column model intercomparison of a heavily drizzling stratocumulus-topped boundary layer. *Journal of Geophysical Research*, D24204, DOI:10.1029/2007JD008536.
Abstract
157. Wyant, M C., Christopher S Bretherton, Julio T Bacmeister, J T Kiehl, Isaac M Held, Ming Zhao, Stephen A Klein, and Brian J Soden, 2006: A comparison of low-latitude cloud properties and their response to climate change in three AGCMs sorted into regimes using mid-tropospheric vertical velocity. *Climate Dynamics*, 27(2-3), DOI:10.1007/s00382-006-0138-4.
Abstract
158. Zhao, Ming, and P H Austin, 2005: Life cycle of numerically simulated shallow cumulus clouds. Part I: Transport. *Journal of the Atmospheric Sciences*, 62(5), 1269-1290.
Abstract
159. Zhao, Ming, and P H Austin, 2005: Life cycle of numerically simulated shallow cumulus clouds. Part II: Mixing dynamics. *Journal of the Atmospheric Sciences*, 62(5), 1291-1310.
Abstract
160. Zhao, Ming, and P H Austin, 2003: Episodic mixing and buoyancy-sorting representations of shallow convection: A Diagnostic Study. *Journal of the Atmospheric Sciences*, 60(7), DOI:10.1175/1520-0469(2003)060<0892:EMABSR>2.0.CO;2.
Abstract

Book Chapter:
Lutsko, N. J., Sherwood, S. C., & **Zhao, Ming** (2023). *Precipitation Efficiency and Climate Sensitivity*. In *Clouds and Climate Monograph*, *Geophysical Monograph Series on Clouds and Their Climatic Impacts: Radiation, Circulation, and Precipitation* (2023). https://doi.org/10.1002/9781119700357.ch13
Non-refereed Publication:
Zhao, Ming, Isaac M Held, and Gabriel A Vecchi, et al., September 2013: Robust direct effect of increasing atmospheric CO2 concentration on global tropical cyclone frequency: a multi-model inter-comparison. *U.S. CLIVAR Variations*, 11(3), 17-23.

Presentations

- **Zhao, Ming** 2024: Crucial Role of Sea Surface Temperature Warming Patterns in Near-Term High-Impact Weather and Climate Projection, *Oxford Workshop on Model Uncertainty on Diagnosing, representing, and reducing Earth System Model uncertainty for weather and climate predictions, University of Oxford, United Kingdom, September 23-26, 2024*
- **Zhao, Ming** 2024: Crucial Role of Sea Surface Temperature Warming Patterns In Projections of High-Impact Weather and Hydrologic and Climate Sensitivity, *The 9th Global Energy and Water Exhanges (GEWEX) Open Science Conference on Climate and Water, Sapporo, Japan, July 7-12, 2024*

- **Zhao, Ming** 2024: Crucial Role of Sea Surface Temperature Warming Patterns in Near-Term High-Impact Weather and Climate Projection, *2024 CFMIP Meeting on Clouds, Precipitation, Circulation, and Climate Sensitivity, University of Boston, USA, June 3-6, 2024*
- **Zhao, Ming** 2023: Sea surface temperature warming patterns are at the heart of future predictions of extreme weather and climate sensitivity, *AGU Fall Meeting 2023, December 11-15, 2023*
- **Zhao, Ming** 2023: *A Study of Convective Clouds in Radiative Convective Equilibrium Using GFDL FV3 Based Non-hydrostatic Cloud Resolving Model, the 6th International Workshop on Nonhydrostatic Models, Hokkaido University, Sapporo, Japan, August 29-Sept 2, 2023*
- **Zhao, Ming** 2023: An analysis of cloud radiative effects based on daily precipitation regimes, *the 2023 joint CFMIP-GASS Meeting on Cloud, Precipitation, Circulation & Climate Sensitivity, Sorbonne University, Paris, France, July 9-13, 2023*
- **Zhao, Ming (invited)** 2022: An Investigation of the Effective Climate Sensitivity in GFDL's New Climate Models CM4.0 and SPEAR, *AGU Fall Meeting 2022, December 12-16, 2022*
- **Zhao, Ming (invited)** 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates, Stony Brook University, School of Marine and Atmospheric Sciences (SoMAS) Seminar, Aug 31, 2022
- **Zhao, Ming** 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates, 3rd Pan-GASS meeting understanding and modeling atmospheric processes, Monterey, CA, USA, *July 25-29, 2022*
- **Zhao, Ming** 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates, 35th Conference on Hurricanes and Tropical Meteorology, New Orleans, LA, USA, *May 9-13, 2022*
- **Zhao, Ming (invited)** 2022: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates, EarthCARE Modeling Workshop 2022, *February 16-18, 2022*
- **Zhao, Ming** 2021: A study of AR-, TS-, and MCS-associated precipitation and extreme precipitation in present and warmer climates, *AGU Fall Meeting 2021, Virtual Conference, December 13-17, 2021*
- **Zhao, Ming** 2021: Simulations of atmospheric rivers, their variability, and response to global warming using GFDL's new high-resolution general circulation model, *The 2021 US Climate Modeling Summit*, *Virtual Conference, June 28-30, 2021*
- **Zhao, Ming** 2020: A study of precipitation extremes and their climate connections using a phenomena-based method, *AGU Fall Meeting 2020, Virtual Conference, December 1-17, 2020*
- **Zhao, Ming** (**invited**) 2020: A model study of precipitation and its extremes using a weather phenomena based method, *NOAA-DOE Precipitation Processes and Predictability Virtual Workshop, November 30-December 2, 2020*
- **Zhao, Ming** 2019: Simulations of atmospheric rivers using GFDL's new generation high-resolution global climate model. *AGU Fall Meeting 2019, San Francisco, December 9-13, 2019*
- **Zhao, Ming** 2019: New generation atmospheric model AM4 and Cloud-Climate Initiative. *2019 GFDL External Science Review, Princeton, New Jersey, Oct. 29-31, 2019*
- **Zhao, Ming** (**invited**) 2019: GFDL New Generation Atmospheric Model AM4 Simulation Characteristics with Prescribed SSTs, *2019 Joint US-Japan Workshop on Climate Change and Variability, Honolulu, Hawaii, March 5-6, 2019*
- **Zhao, Ming** 2019: Simulations of the MJO in GFDL's new generation GCMs and a mechanism study using fully closed moist static energy budget, *The 2019 US Climate Modeling Summit, NASA Goddard Space Flight Center, Greenbelt, MD 20771, April 3-4, 2019*
- **Zhao, Ming** and S-J Lin 2018: A study of convective clouds and their feedbacks in an idealized

radiative convective equilibrium using GFDL non-hydrostatic atmospheric model with horizontal resolutions of 1-24km, *AGU Fall Meeting 2018, Washington DC, December 10-14, 2018*

- **Zhao, Ming** (**invited**) 2018: A Study of Convective Clouds in Radiative Convective Equilibrium Simulated by GFDL FV3 Based Cloud Resolving Model, *Understanding and Modeling the Earth's Climate - a symposium in honor of Isaac Held, Princeton, New Jersey, October 29-31, 2018*
- **Zhao, Ming** 2018: A Study of Convective Clouds in Radiative Convective Equilibrium Simulated by GFDL FV3 Based Cloud Resolving Model, *The 2018 CFMIP meeting on Clouds, Precipitation, Circulation, and Climate Sensitivity, Boulder, Colorado, Oct 16-19, 2018*
- **Zhao, Ming** (**invited**) 2017: GFDL New Generation Atmospheric Model AM4 Simulation Characteristics and Key Processes, *The US-China Coupled Model Inter-comparison Workshop, Beijing, China, August 23-25, 2017*
- **Zhao, Ming** (**invited**) 2016: Bias Reduction as Guidance for Developing Convection and Cloud Parameterization in GFDL AM4/CM4, *AGU Fall Meeting 2016, San Francisco, Dec. 12-16, 2016*
- **Zhao, Ming** (**invited**) 2016: Simulations of the MJO in GFDL's New Generation GCMs and a Mechanism Study Using Fully Closed Moist Static Energy Budget, *AGU Fall Meeting 2016, San Francisco, December 12-16, 2016*
- **Zhao, Ming** 2015: Uncertainty in model climate sensitivity traced to representations of cumulus precipitation microphysics. *Cloud Feedback Model Inter-comparison Project (CFMIP) meeting on cloud processes and climate feedbacks. 8-11 June, 2015, Monterey, California, USA.*
- **Zhao, Ming (invited)** 2015: Development of the atmospheric component of the next generation GFDL climate model. *30st annual meeting of the World Meteorological Organization's Working Group for Numerical Experimentation (WGNE), co-sponsored by the World Climate Research Program (WCRP) and the World Meteorological Organization (WMO) Commission for Atmospheric Sciences (CAS), 23-26 March 2015, College Park, Maryland, USA.*
- **Zhao, Ming (invited)** 2015: Global modeling of tropical cyclone activities and response to global warming using a 50km resolution GFDL HIRAM. *Workshop on High resolution Climate Simulation, Projection, and Application, 19-21 January, Taipei, Taiwan*
- **Zhao, Ming** 2014: Bias reduction as guidance for developing cumulus parameterization in AM4. *GFDL External Science Review, Princeton, New Jersey, USA, 20-22 May, 2014*
- **Zhao, Ming (invited)** 2014: Convection parameterization in GFDL GCMs and new development towards next generation CM4. *1st International Symposium on Climate and Earth System Modeling, 26-27 April, 2014, Nanjing, China.*
- **Zhao, Ming (invited)** 2014: Global modeling of tropical cyclones and their connections to climate. *International Workshop on Climate System Modeling, Hawaii, USA, 10-11 March 2014*
- **Zhao, Ming** 2014: An investigation of the connections between convection, clouds and climate sensitivity in a global climate model. *31st Conference on Hurricanes and tropical Meteorology, San Diego, California, USA, 31 March – 4 April, 2014*
- **Zhao, Ming** 2014: Robust direct effect of increasing atmospheric CO2 concentration on global tropical cyclone frequency – a multi-model inter-comparison. *31st Conference on Hurricanes and tropical Meteorology, 31 March – 4 April, 2014, San Diego, California, USA.*
- **Zhao, Ming** 2014: An investigation of the connections between convection, clouds and climate sensitivity in a global climate model. *94st American Meteorology Society Annual Meeting, 2-6 February, 2014, Atlanta, Georgia, USA.*
- **Zhao, Ming** 2013: An investigation of the connections between convection, clouds and climate sensitivity in a global climate model. *The joint meeting for Cloud Feedback Model Inter-comparison Project (CFMIP) and European Union Cloud Inter-comparison, Process Study and Evaluation Project (EUCLIPSE), 10-14 June 2013, Hamburg, Germany.*
- **Zhao, Ming** 2013: Response of global tropical cyclone frequency to a doubling of CO2 and

uniform SST warming – a multi-model inter-comparison. *U.S. CLIVAR Hurricane Workshop, 5-7 June 2013, Princeton, New Jersey, USA.*

- **Zhao, Ming** 2013: An investigation of the connections between convection, clouds and climate sensitivity in a global climate model. *6th Northeast Tropical Workshop, 29-31 May, 2013, Rensselaerville, New York, USA.*
- **Zhao, Ming**, I.M. Held, S-J Lin 2012: Some counter-intuitive dependencies of tropical cyclone frequency on parameters in a GCM. *1st Pan-Global Atmosphere System Studies (GASS) Conference, 10-14 September 2012, Boulder, Colorado, USA.*
- **Zhao, Ming** and I.M. Held, 2012: TC-permitting GCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. AMS 30th Conference on Hurricanes and Tropical Meteorology. *15-20 April 2012, Ponte Vedra Beach, Florida, USA.*
- **Zhao, Ming**, 2012: Shallow cumulus convection and its parameterizations in AM3. *GFDL Summer School Lectures. 18 July 2012, Princeton, New Jersey, USA.*
- **Zhao, Ming** (**invited**) 2012, TC-permitting GCM simulations of global hurricane climatology, variability and response to warming projected for the late 21st century, *Department Seminar, Atmospheric, Ocean and Space Sciences, University of Michigan, 15 March, 2012.*
- **Zhao, Ming**, 2012: Results from GFDL HiRAM simulations. *US-CLIVAR Hurricane Working Group Workshop, 27-28 January 2012, New Orleans, LA, USA.*
- **Zhao, Ming** and I.M. Held, 2012: TC-permitting GCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. 24th Conference on Climate Variability and Change. *92nd AMS Annual Meeting, 22-26 January 2012, New Orleans, LA, USA.*
- **Zhao, Ming**, 2011: High resolution AGCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. *GFDL's Climate Modeling and Research Symposium. 17 October, GFDL, Princeton, USA.*
- **Zhao, Ming** and I.M. Held, 2011: TC-permitting GCM simulations of hurricane frequency response to sea surface temperature anomalies projected for the late 21st century. *5th Northeast Tropical Workshop. 17-19 May 2011, MIT, Massachusetts, USA.*
- **Zhao, Ming** (**invited**) 2011, Simulations of global hurricane climatology, variability and response to global warming using a high resolution AGCM, *School of Engineering and Applied Science (SEAS) Colloquium in Climate Science, Columbia University, 7 April, 2011, New York City, USA.*
- **Zhao, Ming** (**invited**) 2010: An Analysis of GCM simulated storm intensity variability and change using a statistical refinement. *American Geophysical Union 2010 Fall Meeting, 13-17 December, 2010, San Francisco, USA.*
- **Zhao, Ming** (**invited**) 2010: Simulations of global hurricane climatology, variability and response to global warming using a 50km resolution GCM. *American Geophysical Union 2010 Fall Meeting, 13-17 December, 2010, San Francisco, USA.*
- **Zhao, Ming**, I.M. Held, S-J Lin, G. Vecchi 2010: Simulation of global hurricane climatology, variability, and response to global warming using a new global high resolution atmospheric model. *AMS 29th Conference on Hurricanes and Tropical Meteorology, 10-14 May 2010, Tucson, USA.*
- **Zhao, Ming**, I.M. Held, S-J Lin, G. Vecchi 2009: Simulation of Global Hurricane Climatology, Variability, and Response to Global Warming using a Global High Resolution Atmospheric Model. *MOCA 2009: the IAMAS, IAPSO and IACS Joint Assembly, 19-29 July 2009, Montreal, Canada.*
- **Zhao, Ming**, 2009: Hurricane Climate Connection in a high resolution GCM. NCAR ECSA Junior Faculty Forum on Future Scientific Directions: *Connecting Weather and Climate in Theory, Models and Observations, 14-16 July 2009, NCAR, Boulder, Colorado, USA.*

- **Zhao, Ming**, I.M. Held, S-J Lin, G. Vecchi 2009: Modeling global hurricane climatology, variability, and response to global warming. *2009 GFDL External Science Review, 30 June - 2 July 2009, Princeton, New Jersey, USA.*
- **Zhao, Ming** (**invited**) 2008: Sensitivity of GCM simulated clouds to cumulus mixing, convective cloud microphysics and its implications for cloud feedback to climate sensitivity. *The 4th Pan-GEWEX Cloud System Study (GCSS) Meeting on: Advances in Modeling and Observing Clouds and Convection, 2-6 June 2008, Meteo-France, Toulouse, France.*
- **Zhao, Ming** 2006: GFDL AM2 cloud sensitivity to details in convection and cloud parameterizations, a GPCI case study. *Joint GCSS-GPCI/BLCI-RICO Workshop, 18-21 September 2006, Goddard Institute for Space Science, NASA, New York City, USA.*
- **Zhao, Ming** 2005: University of Washington Shallow Cumulus Convection (UWShCu) Scheme in GFDL AM2 - preliminary results. Atmospheric Climate Process Team Annual Meeting, 29-30 November 2005, GFDL, Princeton, New Jersey, USA.
- **Zhao, Ming**, I.M. Held and B. Wyman 2005: The role of cloud radiative forcing in an idealized Walker circulation. The International Association of Meteorology and Atmospheric Sciences (IAMAS) Conference, 2-11 August 2005, Beijing, China.
- **Zhao, Ming**, 2004: Current status on column diagnostics and modeling work at GFDL. Atmospheric Climate Process Team Annual Meeting, 21-23 October 2004, Seattle, Washington, USA.
- **Zhao, Ming** and P.H. Austin, 2003: Trade-wind cumulus transport and the cloud size distribution. Gordon Research Conference 2003: Solar Radiation and Climate, 13-18 July 2003, Colby-Sawyer College, New London, USA.
- **Zhao, Ming** and P.H. Austin, 2003: Trade-wind cumulus cloud parameterization in large scale models: results from large eddy simulations. 37th CMOS Conference, 2-5 June 2003, Ottawa, Canada.
- **Zhao, Ming** and P.H. Austin, 2002: Life cycle of numerically simulated shallow cumulus clouds, Modeling Clouds and Climate Workshop. December 2002, Toronto, Canada.
- **Zhao, Ming** and P.H. Austin, 2002: A diagnostic study of episodic mixing models of shallow cumulus clouds. AMS 15th Symposium on Boundary Layers and Turbulence, 15-19 July 2002, Wageningen, Netherlands.
- **Zhao, Ming** and P.H. Austin, 2002: A diagnostic study of buoyancy-sorting parameterizations of shallow cumulus convection, GCSS-ARM Workshop on the Representation of Cloud Systems in Large-Scale Models, 20-24 May 2002, Kananaskis, Alberta, Canada.
- **Zhao, Ming** and P.H. Austin, 2001: Sensitivity studies of boundary-sorting representation of shallow cumulus parameterizations. 2001 Climate Conference, 20-24 August, 2001, Utrecht, Netherlands.
- **Zhao, Ming** and P. H. Austin, 2000: Sensitivity studies of buoyancy-sorting parameterizations in Canadian GCM Single Column Model. 34th CMOS Conference, 29 May-1 June, 2000, Victoria, BC, Canada.