

Zhengyu Liu

Curriculum Vitae

Max Thomas Professor of Climate Dynamics
 Atmospheric Science Program, Department of Geography
 The Ohio State University, 154 N. Oval Mall, Columbus, OH 43210
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Education

Ph.D., Physical Oceanography, MIT (Advisor: J. Pedlosky)	1991
M.S., Dynamic Meteorology, Chinese Academy of Science	1985
B.S., Applied Mathematics, Nanjing Institute of Meteorology, China	1982

Professional Appointments

2017-	Professor, Byrd Polar and Climate Research Center, The Ohio State University
2017-	Max Thomas Professor of Climate Dynamics, The Ohio State University
2002-2017	Professor, University of Wisconsin-Madison
2002-2011	Director, Center for Climatic Research, UW-Madison
1999-2001	Associate Director, Center for Climatic Research, UW-Madison
1998-2001	Associate Professor, University of Wisconsin-Madison
1993-1998	Assistant Professor, University of Wisconsin-Madison
1991-1993	Postdoctoral Fellow, Princeton University
1985-1987	Lecturer of Meteorology, Graduate School, Chinese Academy of Sciences

Research Interests

Ocean-atmosphere-land interactions and climate dynamics
 Dynamics of oceanic circulation
 Paleoclimate modeling
 Earth system modeling

Honors

The Sverdrup Gold Medal of American Meteorological Society, 2026
 The Milutin Milanković Medal for Climate Change, the European Geosciences Union, 2025
 The Bert Bolin Award/Lecture for Global Environmental Change, American Geophysical Union, 2022
 Fellow, American Association for the Advancement of Science, 2020
 Fellow, American Meteorological Society, 2012
 Fellow, American Geophysical Union, 2010
 Vilas Associate Award-UW-Madison, 2000-2003
 Young Investigator Award /Office of Naval Research, 1995
 NOAA Postdoctoral Fellowship on Climate Change, 1991

Other Scholarly Activities

Panel Member/Moderator, National Academies Paleoclimate Workshop, 2021
 Panel Member, Growing Convergence Research/NSF, 2021
 Panel Member, Cyberinfrastructure for Sustained Scientific Innovation, 2020
 Panel Member, Modeling, Analysis and Prediction/NASA, 2017, 2018, 2020
 Associate Editor, Transaction of Atmospheric Sciences, 2015-
 Associate Editor, Earth Environmental Sciences, 2014-
 Associate Editor, Journal of Meteorological Research, 2014-

Advisory Committee, Chinese Climate Modeling Consortium, 2012-2018
 Chinese Ministry of Education, 1000-talent scholar, Peking University, 2011
 Visiting scientist, GFDL/NOAA, 2009
 Senior visiting scientist, MPI/Hamburg/Germany, 2008-2009
 Faculty fellowship award, NCAR, 1995,1996, 2002, 2008
 Member, Grand Challenge Task force, DOE, 2008
 Member, Post-ESH working group, 2007
 Member, NSF paleo-proxy working group, 2005
 Co-chair, CCSM paleoclimate working group, 2005-2008
 Member, U.S. CLIVAR-Pacific steering committee, 2004
 Member, Tropical past climate working group, 2003
 Senior Visiting Professor Award, The University of Tokyo, Japan, 2002
 Chinese Ministry of Education, Yangtze scholar, Ocean University of China, 2001
 Member, Marine Earth System History steering committee, 2001
 Member, Shallow STC and Climate working group, 2000
 Honorary Professor, Institute of Environmental Sciences, Chinese Academy of Sciences, 2000
 Excellent Overseas Chinese Scientist Award, Chinese NSF, 2000
 Vilas Associate Professor, UW-Madison, 1999
 Member, U.S. PAGE/CLIVAR working group, 1999
 Member, Graduate School Research Committee, UW-Madison, 1999-2002
 Member, Steering Committee, Asian Partnership Program/UW-Madison, 1999-2004
 Visiting Scientist, IPRC, University of Hawaii, 1999
 Member, Advisory Panel of NCAR Supercomputing, 1998-00

Student Advising

Ph.D students

Boyin Huang, E. Bayler, S. Shin, D. Lee, Yafang Zhong, Wei Liu, Yun Liu, Feng He, Guangshen Chen, Xiaojie Zhu, Na Wen, Jiaxu Zhang, Fuyao Wang, Jiang Zhu, Lianhua Zhu, Feiyu Lu, Sifan Gu, Shan Li, Zhenyao Lu, Chengfei He, Jian Guan, Jing Han, Yishuai Jin, Chenyu Zhu, Yuchu Zhao, Sheng Wu, Xiong Deng, Jingzhe Sun, Yu Gao, Tianying Liu, Karen Russ, Yuntao Bao, Lingwei Li, Peng Gu, Jinbo Du, Kefan Chen, Andrew George, Abhijeet Mishra, Qiyao Hou, Megan King, Yanmin Qin, Danyao Wu, Shuyan Ding, Yichuan Huang,

M.S. students

K. Sirtangnan, Liping Zhang, S. Ashutosh, W. Lewis, A. Lennan, Lihua Wang, T. Casal, E. Hokanson, E. Ong, J-P, Agenti, Xinrong Wu, Xuefeng, Zhang, M. Wehrenberg, Kuniaki Inoue, Yan Yu, Yun Hang, Haran Liu, Jinxuan Zhu, Lingwei Li, Wilton Aguiar

Postdoc advisees

S. Borisov, Y. Golubev, Lixin Wu, S. Vavrus, Weimin Xu, Dongxiao Wang, T. Inui, Haijun Yang, M. Stephens, Hui Wang, Qiong Zhang, Xiaodong Liu, Li Li, M. Notaro, Jun Cheng, S. Kalpan, Yu Liu, R. Booth, Yi Wang, Guangshen Chen, Shu Wu, Xinyao Ron, Libin Yan, Zhifu Wang, Shuang Yang, Jian Guan, Yishuai Jin, Chenyu Zhu, Qin Wen, Zhaowei Jing, Yuntao Bao, Tianying Liu, Fanyuan Lin

Citation Information

Source: Web of Science (as of Oct 2025)

Total publications: 461

H-index: 84

Total citations: 27,972 (26,092 without self-citation),

Total citing articles: 18,372 (17,991 without self-citation)

Source: Google Scholar Citation (as of Aug, 2026)

Citations: 33085 (All), 14752 (Since 2021)

hi-index: 92 (All), 57 (Since 2021)

i10-index: 351 (All), 252 (Since 2021)

Courses Taught

UW-Madison

AOS171: Global Climate Change

AOS528: Past Climate Changes

AOS611: Geophysical Fluid Dynamics II: Large-Scale Dynamics

AOS660: Introduction to Physical Oceanography.

AOS761: Dynamics of General Oceanic Circulation.

AOS760: Ocean-Atmosphere Interaction and Global Climate Variability

AOS801: Advanced Topics in Ocean Dynamics

AOS801: Data Assimilation and Weather/Climate Prediction

AOS900: Seminar in Classical Problems in Meteorology

AOS901: Seminar in Advanced Dynamics

AOS910: Seminar in Global Climate

AOS960: Seminar in Oceanography

OSU

ASP5952: Dynamic Meteorology I

ASP5951: Dynamic Meteorology II

GEOG8902: Combining Data and Model: Data Assimilation

GEOG8901: Global Climate Change

GEOG8901: Ocean and Climate

GEOG8901: Ocean Dynamics

Publications (first author as my student/postdoc with *)**In Press**

- Lei, L., H. Sun, Z-M Tan, L. Ning and **Z. Liu**, 2025: Strongly Coupled Data Assimilation for Paleoclimate Reconstruction Using Deep Learning Based Models. *J. Adv. Modeling Earth Sys.*, DOI: 10.1029/2025MS005686
- Lei L. et al., 2026: Non-Gaussian Assimilation of Atmospheric and Oceanic Data in Latent Space for Paleoclimate Reconstruction *J. Adv. Modeling Earth Sys.*, DOI: 10.1029/2026MS005767
- Sanchez S., P. U. Clark, C. Zhu, F. He and **Z. Liu**, 2026: Attribution of late-Pleistocene changes in Earth's energy imbalance. *Science Advance*, in press.
- Ning, L., et al., 2026: Precipitation Reconstruction in the Asian Monsoon Region During the 4.2 ka Event with Paleoclimate Data Assimilation. *J. Geophys. Res.*, in press.

2026

- Wen Q., **Z. Liu**, T. Wang, J. Liu, M. Yan, L. Ning, Z. Jing, H. Liu, J. Lei, J. Lu and Q. Yin, 2026: Contrasting Marine and Terrestrial Responses of South Asian Summer Monsoon System Caused by Hemispheric Insolation. *Proc. Nat. Aca. Sci.* **123** (33), e2602012123 DOI: [10.1073/pnas.2602012123](https://doi.org/10.1073/pnas.2602012123)
- Chen, K., **Z. Liu**, L. Ning, J. Liu, L. Lei, M. Mann, M. Yan, W. Sun, H. Sun, W. Hu, Y. Qin, F. Xing, Q. Wen, P. Gu, Y. Bao, L. Li and J. Du, 2026: Volcanic eruptions caused weakening of the Atlantic Meridional Overturning Circulation during the preindustrial past millennium. *Nat. Commun.*, DOI:10.1038/s41467-026-74873-5
- Liu**, Z. and P. Gu, 2026: Assessing oceanic forcing on sea surface temperature variability from surface heat budget. *J. Climate*, DOI:10.1175/JCLI-D-25-0549.1.
- Kong, X., **Z. Liu**, M. Yan, Q. Wen, S. Bova, Y. Rosenthal, L. Ning, J. Liu and F. Xie, 2026: Linear and Nonlinear Responses of Annual Mean Sea Surface Temperature to Orbital Forcing. *Quat. Sci. Rev.*, **375**, doi:10.1016/j.quasirev.2025.109790
- Ning, L., F. Xing, **Z. Liu**, J. Liu, Y. Qin, Q. Wen, M. Mann, Y. Yu, Y. Wang, M. Yan, H. Lu, N. Cao, K. Chen and W. Sun, 2026: Holocene Hydroclimatic variations over western and central Asia as inferred from speleothem isotope evidence. *J. Geophys. Res.: Atmos.* **131**, e2025JD045672, DOI: 10.1029/2025JD045672
- Ning, L., J. Liu, **Z. Liu**, F. Xiang, Fen Wu, M. Yan, Z. Meng, K. Chen, Y. Qin, W. Sun and Q. Wen, 2025: Progress and prospects of paleoclimate data assimilation. *Science China: Earth Science*. <https://doi.org/10.1007/s11430-025-1810-2>
- Qin, Y., **Z. Liu**, L. Ning, J. Liu, L. Li, Y. Bao, W. Hu, P. Gu, M. Yan, W. Sun, K. Chen, F. Xing and C. Xu, 2026: Preferred time scales of Pacific decadal variability during the last millennium related to volcanic activity. *Geophys. Res. Lett.*, **53**, e2025GL118881. <https://doi.org/10.1029/2025GL118881>
- Ji, C., Q. Wen, **Z. Liu**, J. Liu, D. Chen, L. Ning, M. Yan, and Q. Yin, 2026: A dipole pattern of orbital-scale precipitation oxygen isotope variation in North African monsoon region and the driving mechanism, *Atmos. Chem. Phys.*, **26**, 5861–5878, <https://doi.org/10.5194/acp-26-5861-2026>.
- Xing, F., L. Ning, **Z. Liu**, J. Liu, M.E. Mann, F. Wu et al., 2026: Precipitation reconstruction in the Asian monsoon region during the 4.2 ka event with paleoclimate data assimilation. *J. Geophys. Res: Atmos.* **131**, e2025JD045745. <https://doi.org/10.1029/2025JD045745>
- Lin, Z., S. Zhang, **Z. Liu**, Y. Jin, L. Wan, S. Cheng, Y. Gao, X. Yu and M. Li, 2026: Non-Gaussian assimilation of atmospheric and oceanic data in latent space for paleoclimate reconstruction. *J. Adv. Modeling Ear. Sys.* **18**, e2026MS005767. doi: 10.1029/2026MS005767

Wen, Q., T. Wang, **Z. Liu**, D. Chen, J. Liu, L. Ning, M. Yan, Z. Jing, H. Liu, J. Lei, J. Lu, X. Zhang and Q. Yin, 2026: Phase Contrast in Asian Summer Monsoon rainfall between Marine and Terrestrial Records on Precessional Timescales and Their Driving Mechanisms. *Sci. China Earth Sci.* **69**, 1645–1658. <https://doi.org/10.1007/s11430-025-1860-0>

George, A.*, **Z. Liu**, P. Gu and T. Liu, 2026: Excessive negative surface heat flux-surface temperature feedback in CMIP6 models. *J. Geophys. Res.*, DOI: 10.1029/2026JC024124

2025

Liu, Z., J. Cheng, Y. Zheng, W. Zhang, H. Liu, H. Wu, J. Zhu and S. Xie, 2025: The Holocene seasonal temperature conundrum. *Sci. Adv.* **11**, eadt8950. DOI: [10.1126/sciadv.adt8950](https://doi.org/10.1126/sciadv.adt8950)

Zhang Z, **Z. Liu**, G. Li, Q. Wen, H. Cheng, R. L. Edwards, T. Li, S. C. Clemens, Y. Wang, Y. Cai, Y. Sun, Z.H. Liu, Z. Shi, Z. Jin, W. Zhou, Z. An, 2025: Summer and non-summer signals in speleothem $\delta^{18}\text{O}$ record revealed by loess microcodium $\delta^{18}\text{O}$. *Proc. Nat. Aca. Sci.*, doi: [10.1073/pnas.2425565122](https://doi.org/10.1073/pnas.2425565122).

Thirumalai, K., S. C. Clemens, Y. Rosenthal, S. Conde, K. Bu, S. Desprat, M. Erb, J. Cheng, L. Li, **Z. Liu**, L. Zhou, L. Giosan, A. Singh and V. Mishra, 2025: Strong and weak Indian Summer Monsoon extremes restrict Bay of Bengal primary production. *Nat Geosci*, doi: 10.1038/s41561-025-01684-6.

Lu, W., D. W. Oppo, A. Condron, **Z. Liu**, C. Zhu, J. Lynch-Stieglitz, W. Guo, A. V. Hess and S. Wang, 2025: Warmer shallow Atlantic during deglaciation and early Holocene due to weaker overturning circulation. *Nat Geosci*, doi: 10.1038/s41561-025-01751-y

Clark, P.U., J. D. Shakun, Y. Rosenthal, D. Pollard, S. W. Hostetler, P. Kohler, P. J. Bartlein, J. M. Gregory, C. Zhu, D. P. Schrag, **Z. Liu**, N. G. Pisias, 2025: Global sea level over the past 4.5 million years. *Science*, **390**, 6770, doi: 10.1126/science.adv8389

Chen Y., Y. Jin, **Z. Liu**, X. Shen, X. Chen, R. Zhang, W. Zhang, W. Duan, F. Zheng, M. J. McPhaden, L. Zhou and J. Zheng, 2025: Combined Dynamical-Deep Learning ENSO forecasts. *Nature Comm.*, **16**, 3845. doi:10.1038/s41467-025-59173-8.

Gu, S., **Z. Liu**, N. Zhao, T. Chen, J. Yu, J. Zhang, C. He, S. Chen, Z. Zhang, L. Li and A. Jahn, 2025: Reduced Antarctic Bottom Water overturning rate during the early last deglaciation inferred from radiocarbon records. *Nat Commun*, 16,7777, doi:10.1038/s41467-025-62958-6.

Zheng, Y., **Z. Liu**, W. Zheng and H. Liu, 2024: The Northern Hemisphere Mid-Latitudes as a Key Region for Reconciling the Holocene Temperature Conundrum. *Quat. Sci. Rev.* **347**, [10.1016/j.quascirev.2024.109090](https://doi.org/10.1016/j.quascirev.2024.109090)

Liu, T., **Z. Liu** and P. Gu, 2025: Strong wind-driven oceanic forcing on decadal SST variability over global ocean. *Geophys. Res. Lett.*, **53**, e2025GL118782. [10.1029/2025GL118782](https://doi.org/10.1029/2025GL118782)

Wu F., L. Ning, **Z. Liu**, J. Liu, W. Hu, M. Yan, F. Xing, L. Lei, H. Sun, K. Chen, Y. Qin, B. Li, C. Xu, 2024: A new last two millennium 1 reanalysis based on hybrid gain analog offline EnKF and an expanded proxy database. *npj Clim. Atmos. Sci.*, doi:[10.1038/s41612-025-00961-w](https://doi.org/10.1038/s41612-025-00961-w).

Du, J.,***Z. Liu**, S. Gu and L. Li, 2025: Estimating deglaciation ocean ventilation age using radiocarbon: a tracer source weighted B-P method. *npj Clim. Atmos. Sci.* doi: [10.1038/s41612-025-00952-x](https://doi.org/10.1038/s41612-025-00952-x)

Bao*, Y., **Z. Liu**, L. G. Thompson, E. Mosley-Thompson, L. Wan and J. Lu, 2025: Climate simulations and ice core data highlight the Holocene conundrum over tropical mountains. *Comm. Earth & Environment*, doi: [10.1038/s43247-025-02188-2](https://doi.org/10.1038/s43247-025-02188-2)

Bao*, Y., **Z. Liu**, L. G. Thompson, E. Mosley-Thompson, L. Wan and J. Lu, 2025: Model Sensitivity to Insolation Forcing and its Implications for the Holocene Temperature Conundrum. *Paleoceanography and Paleoclimatology*, doi:10.1029/2024PA004958.

Yan, M., **Z. Liu**, B. Wang, X. Kong, J. Liu, L. Ning and Q. Wen, 2025: The response of AUSM to precession forcing and its relation to EASM and EAWM. *npj Clim Atmos Sci* **8**, 191, <https://doi.org/10.1038/s41612-025-01084-y>

- Liu Y., M. Yan, J. Liu*, S. Wang, **Z. Liu**, L. Ning and Z. Wang, 2025: The co-evolution of East Asian subtropical westerly jet and East Asian summer monsoon during different time periods in the Holocene and its influence on precipitation patterns in China. *Science China, Earth Sciences*, **68**, 1100-1115, [doi:10.1007/s11430-024-1505-3](https://doi.org/10.1007/s11430-024-1505-3)
- Clark P.U., J. D. Shakun, Y. Rosenthal, C. Zhu, P. J. Bartlein, J. M. Gregory, Peter Köhler, **Z. Liu** and D. P. Schrag, 2025: Mean ocean temperature change and decomposition of the benthic $\delta^{18}\text{O}$ record over the past 4.5 million years. *Clim. Past*, **27**, 973-1000, doi:10.5194/cp-21-973-2025
- Jing, Z., **Z. Liu**, S. Zhang, Q. Wen, C. He, Y. Bao and W. Yu 2025: Precipitation oxygen isotope variability across timescales in the East Asia records: two sub-processes of summer monsoon system. *Communications Earth & Environment*, doi:10.1038/s43247-025-02448-1.
- Zhu, C., L. Cheng, **Z. Liu** and P. U. Clark, 2025: Increase in deglacial ocean heat content linked to contrasts in extratropical warming. *Geophys. Res. Lett.*, **52**, e2025GL115538. doi:10.1029/2025GL115538.
- Sun, H., L. Lei, **Z. Liu**, N. Liang and ZM Tan, 2025: An Online Paleoclimate Data Assimilation with a Deep Learning-based Network. *J. Adv. Modeling Earth Sys.*, [doi:10.1029/2024MS004675](https://doi.org/10.1029/2024MS004675)
- Ning L., **Z. Liu**, M. E. Mann, J. Liu, M. Yan, W. Sun, K. Chen and Y. Qin, 2025: Decadal Climate Changes during the Pre-Industrial Common Era: Characteristics and Mechanisms. *Science Bulletin*, **70**, 2190-2203. [doi:10.1016/j.scib.2025.04.056](https://doi.org/10.1016/j.scib.2025.04.056)
- Ning L., F. Xing, **Z. Liu**, J. Liu, M. Mann, F. Wu, L. Lei, Y. Wang, L. Wan, H. Xu, L. Tan, R. S. Bradley, M. Yan, W. Sun, D. Chen, H. LU, Q. Wen, K. Chen and Y. Qin, 2025: Mega-Tropolar precipitation change accompanying water isotopes in the Holocene Asian Summer Monsoon reanalysis. *Geophys. Res. Lett.*, doi:10.1029/2025GL116451
- Obase T., L. Menviel, A. Abe-Ouchi, T. Vadsaria, R. Ivanovic, B. Snoll, S. Sherriff-Tadano, P. J. Valdes, L. Gregoire, M.-L. Kapsch, U. Mikolajewicz, N. Bouttes, D. Roche, F. Lhardy, C. He, B. Otto-Bliesner, **Z. Liu**, W-L Chan, 2025: Multi-model assessment of the deglacial climatic evolution at high southern latitudes. *Clim Past* **21**, 1443-1663.
- Shutkin T., B. G. Mark, N. D. Stansell, R. C. Encarnacion, H. H. Brecher, **Z. Liu**, B. Yadav and F. S. Schoessow, 2024: Modeling the impacts of climate trends and lake formation on the retreat of a tropical Andean glacier (1962-2020). *EGUsphere-The Cryosphere (TC)*, [doi:10.5194/tc-19-4835-2025](https://doi.org/10.5194/tc-19-4835-2025)
- Wan, L., D. Li, C. Zhu, **Z. Liu**, S. Zhang, X. Lin and J. Lu. 2025: Antarctica Circumpolar Current evolution and its relation to Southern Hemisphere Westerly Winds during the Holocene. *Climate Dynamics*, **64**: 1-12. doi: 10.1007/s00382-025-07793-7
- Wan, L., **Z. Liu**, C. He, C. Zhu, S. Zhang, J. Lu and Z. Jing, 2025: The sea level rise of the 8.2ka event simulated by the iCESM1.3 *Climate Dynamics*, DOI: 10.1007/s00382-025-07915-1
- Wu, F., Ning, L., **Z. Liu**, J. Liu, W. Hu, M. Yan, F. X., L. Lei, H. Sun, K. Chen, Y. Qin, B. Li, and C. Xu, 2025: A new last two millennium reanalysis based on hybrid gain analog offline EnKF and an expanded proxy database. *npj Clim Atmos Sci* **8**, 62, doi:10.1038/s41612-025-00961-
- Stansell, N.D., B. A. Steinman, M. Vuille, T. Shutkin, **Z. Liu**, J. M. Licciardi, B. Mark, M.B. Abbott, D.T. Rodbell, D. Sharma and S. Turner, 2026: Tropical South American Climate Variability During Late MIS 3: Low-Latitude Controls and High-Latitude Influences in the Community Earth System Model Version 2 (CESM2) *Paleoceanography and Paleoclimate*, <https://doi.org/10.1029/2025PA005354>.

2024

- Liu, Z.**, S. Gu, S. Zou, S. Zhang, Y. Yu and C. He, 2024: Wind steered Eastern Pathway of Atlantic Meridional Overturning Circulation. *Nat. Geos.*, 10.1038/s41561-024-01407-3.

- Zhu, C*., S. Sanchez, **Z. Liu**, P. Clark, C. He, L. Wan, J. Lu, C. Zhu, L. Li, S. Zhang and L. Cheng: 2024: Enhanced ocean heat storage efficiency during the last deglaciation. *Sci. Adv.* **10**, eadp5156.
- Gu S.* , **Z. Liu**, H. C. Ng, J. Lynch-Stieglitz, J. F. McManus, M. Spall, A. Jahn, C. He, L. Li, M. Yan, L. Wu and S. Zou. 2024: Intensified AMOC Eastern Interior Pathway of Glacial North Atlantic Intermediate Water. *Proc. Nat. Acad. Sci.*, **121**, e2405051121, [doi:10.1073/pnas.2405051121](https://doi.org/10.1073/pnas.2405051121)
- Gu, P* and **Z. Liu**, 2024: Inferring Climate Forcing from the Sea Surface Temperature-Surface Heat Flux relation for SST-coupled oscillatory variability. *Geophys. Res. Lett.* **51**, doi:10.1029/2024GL108552
- Gu, P*, **Z. Liu**, T. Delworth, 2024: Strong oceanic forcing on decadal surface temperature variability over global ocean. *Geophys. Res. Lett.* **51**, e2023GL107401, doi:10.1029/2023GL107401
- Chen, H., Y. Jin, **Z. Liu**, D. Sun, X. Chen, M. J. McPhaden, A. Capotondi and X. Lin, 2024 Central-Pacific El Niño-Southern Oscillation less predictable under greenhouse warming. *Nature Comm.*, 10.1038/s41467-024-48804-1
- Wen, Q.* , **Z. Liu**, J. Liu, S. Clemens, Z. Jiang, Y. Wang, G. Lv, M. Yan, L. Ning, L. Yuan and Y. Gao, 2023: Contrasting Responses of Arabian Sea Upwelling and Indian Summer Monsoon Rainfall to Orbital Forcing. *Comm. Earth & Env.*, 10.1038/s43247-024-01572-8
- Wen, Q*, **Z. Liu**, Z. Jing, S. Clemens, Y. Wang, M. Yan, L. Ning and J. Liu: 2024: Grand Dipole Response of Asian Summer Monsoon to Orbital Forcing. *npj Clim. & Atmos. Sci.*, 10.1038/s41612-024-00749-4
- Sun, H., L. Lei, **Z. Liu**, L. Ning, Z-M Tan, 2024: A Hybrid Gain Analog Offline EnKF for Paleoclimate Data Assimilation. *J. Adv. Modeling Earth Systems*, e2022MS003414
- Liu, T.* , **Z. Liu**, Y. Zhao and S. Zhang, 2024: Strong extratropical impact on observed ENSO events assessed in GFDL CM2.1 Model. *J. Clim.* **37**, 943-962.
- Li, L.* , **Z. Liu**, L. Wang and J. Lu, 2023: Mechanisms of Global Ocean Ventilation Age Change during the Last Deglaciation. *Climate of Past*, <https://doi.org/10.5194/cp-20-1161-2024>
- Ning L., W. Hu, **Z. Liu**, J. Liu, F. Wu, M. Yan, L. Jiang, L. Lei, F. Xing, H. Sun, K. Chen, Y. Qin, W. Sun, Q. Wen and B. Li, 2024: Reconstructing tropical monthly sea surface temperature variability by assimilating coral proxy datasets. *npj Clim. & Atmos. Sci.* **7**, 261, <https://doi.org/10.1038/s41612-024-00816-w>

2023

- Liu, Z.**, Y. Bao, L. G. Thompson, E. Mosley-Thompson, T. Clay, G. J. Zhang, M. Yan, M. Lofverstrom, I. Montanez and J. Oster, 2023: Tropical mountain ice core $\delta^{18}\text{O}$: A Goldilocks indicator of global temperature change. *Science Advance* **9**, eadi6725, 10.1126/sciadv.adi6725
- Liu, Z.**, P. Gu and T. Delworth, 2023: Strong red noise ocean forcing on Atlantic Multidecadal Variability assessed from surface heat flux: theory and application. *J. Clim.* **36**, 53-80, 10.1175/JCLI-D-22-0063.1.
- Liu, Z.**, C. He, M. Yan, C. Buizert, B. L. Otto-Bliesner, F. Lu and C. Zeng, 2023: Reconstructing past Antarctic temperature using present seasonal $\delta^{18}\text{O}$ -inversion layer temperature: Unified Slope Equations and application. *J. Clim.*, **36**, 2933-2957, 10.1175/JCLI-D-22-0012.1
- Liu, Z.**, 2023: Instability of Atlantic Meridional Overturning Circulation: observations, modeling and relevance to present and future. *Atmosphere*, **14**, 1011, 10.3390/atmos14061011
- Liu, Z.**, 2023: Evolution of Atlantic Meridional Overturning Circulation since the Last Glaciation: Model simulations and relevance to present and future. *Philosophical Transactions A*, **381**, 22022190, 10.1098/rsta.2022.0190.
- Zhu, C. *, **Z. Liu**, S. Zhang and L. Wu: 2023: Likely accelerated anthropogenic AMOC weakening emerged in optimal salinity fingerprint. *Na. Comm.*, 10.1038/s41467-023-36288-4

- Zhan, Z., H. Pang, S. Wu, **Z. Liu**, W. Zhang, T. Xu, H. Liu, H. Cheng and S. Hou, 2023: Determining key upstream rainout and convection zones affecting $\delta^{18}\text{O}$ in water vapor and precipitation based on 10-year continuous observations in the East Asian Monsoon region. *Earth & Planetary Sci Lett.*, 10.1016/j.epsl.2022.117912.
- Du, X., J. M. Russell, **Z. Liu**, B. L. Otto-Bliesner, Y. Gao, C. Zhu, D. W. Oppo, M. Mohtadi, V. V. Galy, Y. Yan, Y. Rosenthal, N. Dubois, E. Schefuß and J. Arbuszewski, 2023: North Atlantic cooling triggered a zonal mode over the Indian Ocean during Heinrich Stadial 1. *Sci. Adv.*, 10.1126/sciadv.add4909
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Book Chapters

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- Liu Z.**, 2015: A review of the dynamics of Pacific interdecadal climate variability. *Climate Change: Multidecadal and Beyond. World Scientific Series on Asia-Pacific Weather and Climate*, **Vol.6**, C. P. Chang ed. 159-170.
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- Zhu B.Z., F.F. Jin and **Z. Liu**. 1990: An introduction to the nonlinear dynamics of the atmosphere and ocean. (in Chinese). *China Ocean Press*. 328pp

External Funding Awards

Expired:

- A Model Study of the Interaction of the Tropical-Subtropical Thermocline Circulation. *PI: Z. Liu, Physical Oceanography/NSF, \$160,000, 09/94 - 08/97*
- A Coupled Ocean-Atmosphere Model Study of the Annual Cycle in the Eastern Equatorial Pacific: the Extratropical Influence. *PI: Z. Liu, Pam-America Climate Studies/NOAA, \$127,174, 07/95 -06/97.*
- A Model Study of the Dynamics of the Western Boundary Current/Recirculation System. *PI: Z. Liu, Young Investigator Award/ONR, \$490,000, 06/95 --05/98,*
- Extratropical Climate Variability in the Coupled Ocean-Atmosphere System. *CoPI: Z. Liu (PI: D.D. Houghton, CoPI: R. Gallimore), Climate Dynamics/NSF, \$360,000, 07/95 -- 06/97,*
- Extratropical Climate Variability in the Coupled Ocean-Atmosphere System. *CoPI: Z. Liu (PI: D.D. Houghton, CoPI: R. Gallimore), Climate Dynamics/NSF, \$160,000, 09/97 -- 08/99,*
- Testing Earth System Models with Paleo Observations. *CoPI: Z. Liu, (PI: J. Kutzbach, CoPI: J. Foley), Climate Dynamics/NSF, \$1,050,000, 07/95 - 06/99,*
- Multiple-component Response of the Tropical Atmosphere/ocean/Vegetation system to CO2 increase. *PI: Z. Liu, (CoPI: Kutzbach, J. Foley, J.), Model and Method for Integration Studies/NSF, \$450,000, 09/97-08/00*
- A Coupled Modeling Study of Interdecadal-decadal Climate Variability in the Pacific Ocean Region. *PI: Z. Liu (CoPI: R. Gallimore), Climate Dynamics/NSF \$198,000, 11/98--10/00.*
- Determining the Change of Tropical Pacific Thermocline. *PI: Z. Liu, GOALS/NOAA, \$265,000, 09/98--08/01.*
- Dynamics of Decadal Thermocline Variability in the Extratropics. *PI: Z. Liu, Physical Oceanography Program/NSF, \$270,000, 09/98--08/02.*
- The role of increasing CO2 levels and ocean and vegetation feedbacks in Permian global warming, and comparisons of simulations with observations. *CoPI: Z. Liu (PI: J. Kutzbach), PaleoClim/NSF, \$330,000, 02/99-01/02*
- Testing Earth System Models with Paleo Observations. *CoPI: Z. Liu, (PI: J. Kutzbach), ESH/NSF, \$1,050,000, 7/99 - 6/04,*
- Towards the prediction of decadal to multi-century processes in a high-throughput climate system model. *PI: Z. Liu, (CoPI: J. Kutzbach, R. Jacob, C. Prentice), CCPP/DOE, \$775,000, 09/01-08/04*
- A coupled modeling study of tropical decadal climate variability: extratropical-tropical interactions. *PI: Z. Liu, (CoPI: L. Wu), Physical Oceanography/NASA, \$372,000, 9/01-8/05*
- A pilot study of past decadal climate variability using the combined tree-ring and lake-verve proxy in northern Wisconsin, *PI: Z. Liu, (CoPI: S. Kaplan), \$25,000, 10/03-09/04, E. Wagner Foundation*
- Impact of Anthropogenic forcing on tropical ocean-atmosphere-vegetation system. *PI: Z. Liu, (CoPI: J. Kutzbach, C. Prentice), Climate Dynamics/NSF, \$500,000, 08/00-08/05*
- Determining equatorial thermocline in the tropical climate system. *PI: Z. Liu, CLIVAR-Pacific/NOAA, \$340,000, 09/02--08/06.*
- Quantifying and Understanding the Effects of Extratropical Forcings on Equatorial Pacific Thermocline Using an OGCM and Its Adjoint. *PI: T. Lee at JPL,(CoPI: Z. Liu), CLIVAR-Pacific/NOAA, 340,000, 03/03-02/06*
- Coupled dynamics of tropical Atlantic climate variability. *PI: Z. Liu, CLIVAR-Atlantic/NOAA, \$360,000, 09/02-08/06*
- Understanding Marine Bio-Physical Feedback in the Coupled Ocean-Atmosphere System using Ocean Color Remote Sensing Information, *PI: Z. Liu, NESDIS/NOAA, \$330,000, 06/03-05/06*

- Collaborative Research into Indo-Asian Monsoon Variability: Data and Model Assessment of Northern- and Southern-Hemisphere Mechanisms. (with Brown Univ.) MG&G/NSF, *Co-PI: Z. Liu*, \$240,000, 10/1/04 - 09/30/09
- Modeling climate evolution since the mid-Holocene, ESH/NSF, \$458,000, 07/1/05 - 06/30/09.
- Non-hydrostatic effects on multi-scale coupling in rotating and stratified flows (*with LANL/DoE*), *UW-PI: Z. Liu*, Math/DoE, \$891,000, 10/1/05 - 09/30/09
- Workshop Proposal: Paleoclimate Modeling Intercomparison Project Workshop on Coupled Simulations. (with NCAR), *UW-PI: Z. Liu*, NSF, DOE, NOAA, \$70,000, 9/1/08 - 1/30/9
- Uplift Effect of Tibetan Plateau on global climate. (*with Inst. Earth Environment, CAS*), *UW-PI: Z. Liu*, Chinese NSF, CYen 1,100,000, 01/1/04 - 12/30/09
- Workshop Proposal: Synthesizing Transient Climate Evolution of the last 21,000 years, (SynTraCE-21000) *PI: Z. Liu*, Atm/NSF, \$35,000, 7/1/08 - 6/30/10
- Towards the prediction of decadal to multi-century processes in high-throughput earth system models. *PI: Z. Liu*, CCPP/DoE, \$1,285,000, 09/1/04 - 08/31/11
- A Collaborative Proposal: Simulating and Understanding Abrupt Climate-Ecosystem Changes During Holocene with NCAR-CCSM3 (with NCAR), *PI: Z. Liu*, BER/DoE, \$610,000, 9/1/08 - 8/31/11
- Interdisciplinary Study of Tibetan Plateau Uplift and Its Impact on Asian Monsoon Hydrology. *UW-PI: Z. Liu* (in collaboration with *PI: P. Molnar*, U. Colorado, and several other universities), EAR, ATM/NSF, \$3,000,000, 9/1/09 - 8/31/12
- Vegetation impact on future climate. *PI: Z. Liu*, USDA, \$130,000, 10/01/09 - 09/30/11
- Seasonal and Interannual Prediction of Saudi Arabian Dust Storms. *PI: Z. Liu*, King Saud University, Saudi Arabia., \$150,000, 01/01/10 - 08/31/11
- Vegetation-climate interaction and predictability in the North America. *Co-PI: Z. Liu*, GEWEX/NOAA, \$340,000, 06/1/08 - 05/30/11
- Ecosystem response to future climate change and the impact of vegetation feedbacks in the southwest United States. *Co-PI: Z. Liu*, NICCR/DoE, \$349,075, 07/1/07 - 06/30/10
- PAGES Working Group Proposal Synthesis of Transient Climate Evolution of the last 21-kyr (SynTraCE-21) *PI: Z. Liu*, PAGES., NCAR, NOAA, DOE, \$100,000, 09/01/10 - 08/31/13
- Transient Climate Evolution of the last 21,000 years - Understanding Climate Sensitivity and Abrupt Climate Change using CCSM (TraCE-21000). *PI: Z. Liu*, P2C2/NSF, \$597,319, 7/1/10 - 6/30/13
- Collaborative Research: A Pilot Study of Simultaneous Parameter and State Estimation in Coupled Ocean-Atmosphere General Circulation Models using the Ensemble Kalman Filter, *PI: Z. Liu*, OCN,ATM/NSF, \$509,881, 9/1/10 - 8/31/13
- Collaborative Research: PHASEMAP, a new paradigm for paleoclimate model-proxy comparisons: Stage I, Plio-Pleistocene surface climate and global monsoons (with Brown Univ.) *UW-PI: Z. Liu*, MG&G/NSF, \$420,000, 9/1/11 - 8/31/14
- Collaborative Project: Development of an Isotope-Enabled CESM for Testing Abrupt Climate Changes (with NCAR), *PI: Z. Liu*, SciDAC/DOE, \$999,000, 9/15/11 - 9/14/14
- Collaborative Research: Growth of the Tibetan Plateau and Eastern Asia Climate: Clues to Understanding the Hydrological Cycle, *UW-PI: Z. Liu* (CU *PI: P. Molnar*), EAR/NSF, \$3,000,000, 9/1/12 - 8/31/17
- Collaborative Research: Isotope-enabled Transient Climate Evolution of the last 21,000 years (iTRACE21)—understanding deglacial climate/isotope changes using CESM. *PI: Z. Liu*, P2C2/NSF, \$620,000, 9/1/14 - 8/31/18
- Collaborative Research: Carbon Isotope and geotracer-enabled simulation of transient climate evolution of deglacial ocean (iTRACE-o). *UW-PI: Z. Liu* (with CU), P2C2/NSF, \$610,000, 9/1/16 - 8/31/19
- Collaborative Research: Modeling the coevolution of isotope and East Asia climate in the last 21,000 years. *PI: Z. Liu*, NNSF of China, 1,000K CNY 01/01/2017 - 12/31/2021

Collaborative Research: Open Studio for Ocean-Climate-Isotope Modeling, PI: **Z. Liu**, Qingdao Marine National Laboratory, China, 1,000K CNY, 01/01/2019 - 12/31/2022

Collaborative Research: Projection and mechanism of East Asia monsoon climate response to global warming under the 1.5° warming scenario. CoPI: **Z. Liu**, Chinese Minister of Science and Technology, 1,000K CNY, 01/01/2017 - 12/31/2021

Assessing and understanding extratropical control on tropical climate in coupled ocean-atmosphere system using Regional Coupled Data Assimilation. PI: **Z. Liu**, ClmDyn/NSF, \$499,980, 2/1/18 - 1/31/23

Coupling Approaches for Next-Generation Architectures (CANGA). PI: *P. Jones (LANL/DOE and multi-institutions)*, OSU PI: **Z. Liu**, SciDAC/DOE, \$500,000 (*OSU budget*), 1/7/17 - 6/30/22

Assessing and understanding extratropical control on tropical climate in coupled ocean-atmosphere system using Regional Coupled Data Assimilation. PI: **Z. Liu**, ClmDyn/NSF, \$499,980 (*OSU funding*), 2/1/18 - 1/31/24

Collaborative Research: Paleo-synoptic Changes as Recorded in the Mineral Dust in the Guliya Ice Cap, Northwestern Tibetan Plateau, CoPI: **Z. Liu**, P2C2/AGS/NSF, \$435,592 (*OSU funding*), 05/01/2020 - 04/30/2023

Collaborative Research: Transient forcing of the Local Last Glacial Maximum in the tropical Peruvian Andes, CoPI: **Z. Liu**, P2C2/AGS/NSF, \$305,859 (*OSU funding*), 06/15/2020 - 05/31/2025

Assessing and Understanding Atlantic Multidecadal Variability in a Suite of GFDL Climate Models: Roles of Climate Feedback and Teleconnection, PI: **Z. Liu**, NOAA, \$709,015 (*OSU funding*), 09/01/2020 - 08/31/2025

Crossing Space and Time of Asian-Pacific Climate Evolution. CoPI: **Z. Liu**, China Qingdao Marine Laboratory, CNY 1,000,000, 09/01/2022-08/31/2025.

Collaborative Research: Correcting sea surface temperature proxies for seasonal biases: combined data and model investigation. OSU PI: **Z. Liu**, NSF/MG&G, \$116,017 (*OSU funding*), 09/01/2022-08/31/2026

Current

Improving Projections of AMOC and its Collapse Through advanced Simulations (ImPACTS). PI: **Z. Liu**, coPI: H-W. Shen, DOE, \$1,380,000 (*OSU funding*), 09/01/2022 - 08/31/2027

A model-data approach to better understand paleoclimate records of stable water isotopes in high-elevation, lower-latitude glaciers. PI: **Z. Liu**, (CoPIs: L. Thompson, E. Thompson) NSF/P4Climate, \$892,703 (*OSU funding*), 09/01/2023-08/31/2026

Assessing and understanding oceanic climatic forcing on decadal climate variability from surface heat flux. PI: **Z. Liu**, NSF/Clim. Dyn., \$652,363 (*OSU funding*), 09/01/2023-08/31/2026

Internal UW-Madison Awards:

Detecting interdecadal temperature and salinity variability in the North Atlantic Ocean. *WARF/UW*, \$15,704, 7/94--6/95.

Mid-latitude ocean dynamics and ocean-atmosphere interaction. *WARF/UW*, \$15,704, 7/95--6/96.

Dynamics of Western boundary current/Recirculation system: *WARF/UW*, \$16,000, 7/96--6/97.

Dynamics of Western boundary current/Recirculation system: *WARF/UW*, \$16,000, 7/97--6/98.

Dynamics of North Pacific and climate: *API/UW*, \$7,000, 7/98-6/99

Vilas Associate Award, *Vilas Associate Foundation*, \$60,000, 2000-2003

Study past climate change in the East Asia, *API/UW*, \$17,500, 11/00-10/01

Global decadal variability and reconstruction, *API/UW*, \$15,000, 11/01-10/02

Decadal equatorial variability, *WARF/UW*, \$35,000, 09/02-08/04

An pilot interdisciplinary study of culture and environment in developing countries, *NI/UW*,
\$35,000, 09/07-08/10