Feng Zhu

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Earth System Modeling | Data Assimilation | Machine Learning | Scientific Software Engineering

Education

Aug 2016 — Aug 2021	**Ph.D.** | Earth Sciences *Advisor: Julien Emile-Geay*	**University of Southern California** (USC)
Aug 2014 — May 2016	**M.S.** | Atmospheric & Oceanic Sciences *Advisor: Steven Ackerman*	**University of Wisconsin-Madison** (UW-Madison)
Sep 2012 — Jun 2014	**M.S.** | Meteorology *Advisor: Guoqiang Xu*	**Chinese Academy of Meteorological Sciences** (CAMS)
Sep 2008 — Jun 2012	**B.S.** | Atmospheric Science	**Nanjing University of Information Sci. & Tech.** (NUIST)

Work Experience

May 2024 — Present	**Paleoclimate Software Engineer II**, NSF National Center for Atmospheric Research *Paleoclimate Modeling and Online Data Assimilation, Earth System Model Diagnostics*
Feb 2023 — May 2024	**Paleo & Polar Climate Postdoc Fellow**, NSF National Center for Atmospheric Research *Miocene Climate Change, Paleoclimate Data Assimilation*

Funding History

[4] *Emulating Water Isotopes in Fully-coupled Global Climate Models using Knowledge-guided Machine Learning*
NSF, Collaborations in Artificial Intelligence and Geosciences (CAIG), **Led the Proposal**, 10/1/2025 - 9/30/2028

[3] *Enhancing Safety, Security, and Privacy in the Community Earth System Model (CESM) Ecosystem*
NSF, Safety, Security, and Privacy of Open-Source Ecosystems (Safe-OSE), **Co-led the Proposal**, 1/1/2026 - 12/31/2027

[2] *deepGreen: A deep learning based tree-ring width data model for paleoclimatic data assimilation*
NSF, Paleo Perspectives on Present and Projected Climate (P4CLIMATE), **Led the Proposal**, 7/1/2023 - 6/30/2026

[1] *x4c: Xarray for efficient CESM postprocessing, analysis, and visualization*
NCAR/CGD Stratigic Initiative Fund (SIF), **PI**, 1/1/2025 - 9/30/2025

Publications - Journal Article

[19] **Zhu, F**, Zhu, J., Si, W., Nirenberg, J.E., Herbert, T., Tierney, J.E., Acosta, R.P., Burls, N.J., Evans, D., **2026**. Model-data synthesis of benthic isotopes suggests a warmer Miocene Climatic Optimum. ***Nature Communications*** (IF: 17.694). *In Revision.* Preprint

[18] Si, W., Lee, T., Zeng, W., Nicklas, J., Hu, A., **Zhu, F.**, Herbert, T., **2026**. Robust decision-making via uncertainty quantification in deep learning models for marine microfossil classification. ***Paleoceanography and Paleoclimatology*** (IF: 2.89). *In Revision.*

[17] Cho, P.G., **Zhu, F.**, Bolster, D., Müller, M.F., **2026**. Differential Impacts of Proxy Archives on Paleoclimate Reconstruction Performance. ***Journal of Geophysical Research – Atmosphere*** (IF: 4.1). *In Revision.*

[16] Sanchez, S.C., **Zhu, F.**, Saenger, C., Thompson, D.M., **2026**. Paleo data assimilation of coral δ18O Part 1: Best practices and uncertainties. ***Paleoceanography and Paleoclimatology*** (IF: 2.89). *In Revision.* Preprint

[15] Sanchez, S.C., **Zhu, F.**, Saenger, C., Thompson, D.M., **2026**. Paleo data assimilation of coral δ18O Part 2: 20th century trends and variability of the tropical Pacific. ***Paleoceanography and Paleoclimatology*** (IF: 2.89). *In Revision.* Preprint

[14] Evans, M.N., Lücke, L.J., Fan, K.J., **Zhu, F**, **2025**. A database of databases for Common Era paleoclimate applications. ***Earth System Science Data*** (IF: 11.6). *Accepted.* Preprint

[13] Nsingi, J.M., Cui, Y., Cepin, E., Beaty, B., Planavsky, N., Wu, Q., Adloff, M., Wang, J., Selby, D., Liu, Z., Dong, Y., Jiang, S., **Zhu, F**, **2025**. Changes in continental weathering across the Permian-Triassic transition: A global review. ***Global and Planetary Change*** (IF: 4.0). doi:10.1016/j.gloplacha.2025.105015

[12] Luo, J., Hu, J., **Zhu, F**, Liang, R., Zhou, Z., **2025**. The unstable East Asian Summer Monsoon - ENSO relationship over the past 700 years. ***Global and Planetary Change*** (IF: 4.0). doi:10.1016/j.gloplacha.2025.104842

[11] Emile-Geay, J., Hakim, G.J., Viens, F., **Zhu, F**, Amrhein, D.E., **2025**. Temporal Comparisons Involving Paleoclimate Data Assimilation: Challenges & Remedies. ***Journal of Climate*** (IF: 5.38). doi:10.1175/JCLI-D-24-0101.1.

[10] **Zhu, F**, Emile-Geay, J., Hakim, G.J., Khider, D., Tardif, R., Perkins, W.A., **2024**. cfr (v2024.1.26): a Python package for climate field reconstruction. ***Geoscientific Model Development*** (IF: 6.892). doi:10.5194/gmd-17-3409-2024.

[9] **Zhu, F**, Emile-Geay, J., Anchukaitis, K.J., McKay, N.P., Stevenson, S., Meng, Z., **2023**. A pseudoproxy emulation of the PAGES 2k database using a hierarchy of proxy system models. ***Scientific Data*** (IF: 8.501). doi:10.1038/s41597-023-02489-1.

[8] Khider, D., Emile-Geay, J., **Zhu, F**, James, A., Landers, J., Ratnakar, V., Gil, Y., **2022**. Pyleoclim: Paleoclimate Timeseries Analysis and Visualization with Python. ***Paleoceanography and Paleoclimatology*** (IF: 2.89). doi:10.1029/2022PA004509.

[7] **Zhu, F**, Emile-Geay, J., Anchukaitis, K.J., Hakim, G.J., Wittenberg, A., Morales, M., King, J., **2022**. A re-appraisal of the ENSO response to volcanism with paleoclimate data assimilation. ***Nature Communications*** (IF: 17.694). doi:10.1038/s41467-022-28210-1.

[6] Power, S., Lengaigne, M., Capotondi, A., Khodri, M., Vialard, J., Jebri, B., Guilyardi, E., McGregor, S., Kug, J.S., Newman, M., McPhaden, M.J., Meehl, G., Smith, D., Cole, J., Emile-Geay, J., Vimont, D., Wittenberg, A.T., Collins, M., Kim, G.-I., Cai, W., Okumura, Y., Chung, C., Cobb, K.M., Delage, F., Planton, Y.Y., Levine, A., **Zhu, F**, Sprintall, J., Di Lorenzo, E., Zhang, X., Luo, J.-J., Lin, X., Balmaseda, M., Wang, G., Henley, B.J., **2021**. Decadal climate variability in the tropical Pacific: Characteristics, causes, predictability, and prospects. ***Science*** (IF: 63.714). doi:10.1126/science.aay9165.

[5] King, J.M., Anchukaitis, K.J., Tierney, J.E., Hakim, G.J., Emile-Geay, J., **Zhu, F**, Wilson, R., **2021**. A data assimilation approach to last millennium temperature field reconstruction using a limited high-sensitivity proxy network. ***Journal of Climate*** (IF: 5.38). doi:10.1175/JCLI-D-20-0661.1.

[4] **Zhu, F**, Emile-Geay, J., Hakim, G.J., King, J., Anchukaitis, K.J., **2020**. Resolving the differences in the simulated and reconstructed climate response to volcanism over the last millennium. ***Geophysical Research Letters*** (IF: 5.576). doi:10.1029/2019GL086908.

[3] **Zhu, F**, Emile-Geay, J., McKay, N.P., Hakim, G.J., Khider, D., Ault, T.R., Steig, E.J., Dee, S., Kirchner, J.W., **2019**. Climate models can correctly simulate the continuum of global-average temperature variability. ***Proceedings of the National Academy of Science*** (IF: 12.779). doi:10.1073/pnas.1809959116.

[2] PAGES 2k Consortium (Neukom, R., Barboza, L.A., Erb, M.P., Shi, F., Emile-Geay, J., Evans, M.N., Franke, J., Kaufman, D.S., Lücke, L., Rehfeld, K., Schurer, A., **Zhu, F**, Brönnimann, S., Hakim, G.J., Henley, B.J., Ljungqvist, F.C., McKay, N., Valler, V., von Gunten, L.), **2019**. Consistent multidecadal variability in global temperature reconstructions and simulations over the Common Era. ***Nature Geoscience*** (IF: 21.531). doi:10.1038/s41561-019-0400-0.

[1] **Zhu, F**, Xu, G., Zheng, X., Wang, Y., **2015**. Superparameterization in GRAPES: the construction of SP-GRAPES and associated preliminary results. ***Journal of Meteorological Research*** (IF: 2.569). doi:10.1007/s13351-015-4074-2.

Publications - Book Chapter

[1] Julien Emile-Geay, Kim M. Cobb, Julia E. Cole, Mary Elliot, and **Feng Zhu**, **2020**: Past ENSO Variability: Observations, Models, and Implications. In ***El Niño and Southern Oscillation in A Changing Climate***, Book Chapter 5. *American Geophysical Union.* doi:10.1002/9781119548164.ch5.

Reviews - Research Proposal

[1] **ERC Consolidator Grant (up to 3 million EUR)**. European Research Council (ERC). Aug 2023.

Reviews - Journal Article

[35] *Climate of the Past* (IF: 4.295). Jan 2026.
[34] *Journal of Climate* (IF: 5.38). Oct 2025.
[33] *Journal of Climate* (IF: 5.38). May 2025.
[32] *Geosci. Model Development* (IF: 6.892). May 2025.
[31] *Comms Earth & Environment* (IF: 8.4). May 2025.
[30] *Geosci. Model Development* (IF: 6.892). Feb 2025.
[29] *Nature* (IF: 69.504). Jan 2025.
[28] *Geosci. Model Development* (IF: 6.892). Aug 2024.
[27] *Nature* (IF: 69.504). Jul 2024.
[26] *J. Adv. Modeling Earth Systems* (IF: 6.660). Jun 2024.
[25] *Geosci. Model Development* (IF: 6.892). Jun 2024.
[24] *Geosci. Model Development* (IF: 6.892). Apr 2024.
[23] *JGR: Atmosphere* (IF: 4.4). Apr 2024.
[22] *Geophysical Research Letters* (IF: 5.76). Apr 2024.
[21] *Nature* (IF: 69.504). Jan 2024.
[20] *Nature* (IF: 69.504). Jan 2024.
[19] *Geosci. Model Development* (IF: 6.892). Dec 2023.
[18] *Climate Dynamics* (IF: 4.6). Oct 2023.
[17] *Geophysical Research Letters* (IF: 5.76). Aug 2023.
[16] *Geophysical Research Letters* (IF: 5.76). Jul 2023.
[15] *JGR: Atmosphere* (IF: 4.4). May 2023.
[14] *Geo-spatial Information Sci.* (IF: 4.278). Apr 2023.
[13] *Climatic Change* (IF: 4.743). Jan 2023.
[12] *Science Advances* (IF: 14.136). Dec 2022.
[11] *Atmosphere* (IF: 3.11). Dec 2022.
[10] *Atmosphere* (IF: 3.11). Aug 2022.
[9] *Nature Communications* (IF: 17.694). Mar 2022.
[8] *Climate of the Past* (IF: 4.295). Jan 2022.
[7] *Nature Communications* (IF: 17.694). Jan 2022.
[6] *Nature* (IF: 69.504). Nov 2021.
[5] *Nature* (IF: 69.504). Nov 2021.
[4] *The Holocene* (IF: 2.595). May 2021.
[3] *Climatic Change* (IF: 4.743). Feb. 2021.
[2] *Climate of the Past* (IF: 4.295). Feb 2021.
[1] *Nature* (IF: 69.504). Aug 2020.

Reviews - Book

[1] *Thunder & Lightning: Weather Past, Present, Future (Chinese version).* Author: Lauren Redniss. Translator: Yuanbao Luo. May 2022. *Post Wave Publishing.* ISBN: 9787559659699.

Other Professional Services

[4] **Convener**: AGU Session - CyberPaleo: Informatics Approaches to the Paleogeosciences. Dec 2023.

[3] **Lab Session Assistant**: The Community Earth System Model (CESM) Tutorial 2023. Jul 2023.

[2] **Judge**: Colorado-Wyoming Junior Academy of Science (CWJAS) Annual Science Symposium. Apr 2023.

[1] **M.S. Thesis Committee**: Fujian Normal University. May 2022.

Research Supervision

PhD Dissertation Cho, P. G. (2025). *Linking Past and Present Hydroclimate Through Walker Circulations, Proxies, and Data Assimilation (Version 1).* University of Notre Dame. doi:10.7274/30688061.v1

Senior Thesis Wang, C. (2022). *A Machine Learning Based Simulation Study of Ice Core Oxygen Isotope Data.* NUIST.

Teaching Experience

Spring 2026	**Guest Lecturer**, Department of Atmospheric & Oceanic Sciences, CU Boulder *Dynamics of Past Climate Changes: Lessons for the Future (10 students/session, 1 session)*
Spring 2022	**Assistant Professor**, School of Atmospheric Sciences, NUIST *Linux and Python for Meteorology (121 students/session, 1 session)*
Fall 2018	**Teaching Assistant** funded by USC Dornsife College *GEOL 150: Climate Change (15 students/session, 3 sessions)*
Spring 2018	**Teaching Assistant** funded by USC Dornsife College *GEOL 107: Oceanography (15 students/session, 3 sessions)*
Spring 2017	**Teaching Assistant** funded by USC Dornsife College *GEOL 150: Climate Change (20 students/session, 2 sessions)*

Academic Presentations

[32] **CESM Paleoclimate Working Group Workshop 2026**. New Orleans, LA: *Emulating Water Isotopes in Coupled Earth System Models.* **Talk**. Feb 2026.

[31] **AGU Fall Meeting 2025**. New Orleans, LA: *Emulating Water Isotopes in Coupled Earth System Models.* **Poster**. Dec 2025.

[30] **NCAR Earth System Data Science Forum**. Boulder, CO: *x4c: Xarray for efficient CESM postprocessing, analysis, and visualization.* **Talk**. Nov 2025.

[29] **CESM Workshop 2025**. Boulder, CO: *Advancing Deep-Time Climate Reconstruction with a New Online Paleoclimate Data Assimilation Approach in CESM.* **Talk**. Jun 2025.

[28] **CESM Paleoclimate Working Group Workshop 2025**. Boulder, CO: *Bridging the Miocene Climatic Optimum warmth gap with equilibrated isotope-enabled CESM simulations.* **Talk**. Jan 2025.

[27] **AGU Fall Meeting 2024**. Washington, D.C.: *Bridging the Miocene Climatic Optimum warmth gap with equilibrated isotope-enabled CESM simulations.* **Talk**. Dec 2024.

[26] **UConn Workshop on "Climate evolution from early Eocene to mid-Pliocene: insights from proxy data and climate models"**. Storrs, CT: *Revisiting Miocene Climatic Optimum with equilibrated isotope-enabled CESM simulations.* **Talk**. Oct 2024.

[25] **CESM Workshop 2024**. Boulder, CO: *Revisiting Miocene Climatic Optimum with a unique equilibrated iCESM simulation.* **Talk**. Jun 2024.

[24] **CESM Workshop 2024**. Boulder, CO: *x4c: Xarray for CESM.* **Poster**. Jun 2024.

[23] **CESM Workshop 2024**. Boulder, CO: *cfr: a Python package for climate field reconstruction.* **Poster**. Jun 2024.

[22] **Department Seminar at Woods Hole Oceanographic Institution**. Online: *Paleoclimate Data Assimilation: from the Last Millennium to the Deep Time.* **Invited Talk**. Jun 2024.

[21] **Miocene Climate Workshop**. Tucson, AZ: *Revisiting Miocene Climatic Optimum with Paleoclimate Data Assimilation.* **Poster**. Mar 2024.

[20] **AGU Fall Meeting 2023**. San Francisco, CA: *cfr: a Python package for climate field reconstruction.* **Poster**. Dec 2023.

[19] **World Climate Research Programme (WCRP) Open Science Conference**. Kigali, Rwanda: *cfr: a Python package for climate field reconstruction.* **Poster**. Oct 2023.

[18] **Building Upon the EarthCube community workshop**. Los Angeles, CA: *cfr: a Python package for climate field reconstruction.* **Poster**. Jun 2023.

[17] **CESM Workshop 2023**. Boulder, CO: *Volcanism and ENSO: a re-appraisal with paleoclimate data assimilation.* **Talk**. Jun 2023.

[16] **CESM Workshop 2023**. Boulder, CO: *cfr: a Python package for climate field reconstruction.* **Poster**. Jun 2023.

[15] **The 8th Geosciences Youth Forum**. Online: *Volcanism and ENSO: a re-appraisal with paleoclimate data assimilation.* **Invited Talk**. May 2023.

[14] **The 308th Shuangqing Forum**. Online: *Advances in paleoclimate data assimilation.* **Talk**. Apr 2022.

[13] **Department Seminar at Nanjing University**. Online: *Advances in paleoclimate data assimilation.* **Invited Talk**. Mar 2022.

[12] **PMIP 2020 Conference**. Online: *Resolving the differences in the simulated and reconstructed temperature response to volcanism over the Last Millennium Reanalysis.* **e-Lightening**. Oct 2020.

[11] **Graduate Climate Conference**. Online: *Resolving the differences in the simulated and reconstructed temperature response to volcanism over the Last Millennium Reanalysis.* **Poster**. Oct 2020.

[10] **EGU General Assembly 2020**. Online: *Resolving the differences in the simulated and reconstructed temperature response to volcanism over the Last Millennium Reanalysis.* **Online Discussion**. May 2020.

[9] **AGU Fall Meeting 2019**. San Francisco, CA: *The climate response to Common Era volcanism: insights from the Last Millennium Reanalysis.* **Talk**. Dec 2019.

[8] **CLIVAR Water Isotopes and Climate Workshop**. Boulder, CO: *Direct assimilation of water isotope observations in the Last Millennium Reanalysis.* **Poster**. Oct 2019.

[7] **Data Assimilation, Reanalyses and Proxy System Modeling in Paleoenvironmental Science 2nd Workshop**. College Park, MD: *PAGES2k pseudoproxy emulations.* **Talk**. May 2019.

[6] **Climate Variability across Scales (CVAS) 3rd Workshop**. Seattle, WA: *Do climate models underestimate the global temperature variability?* **Talk**. Jan 2019.

[5] **AGU Fall Meeting 2018**. Washington, DC: *Can climate models correctly simulate the continuum of temperature variability?* **Talk**. Dec 2018.

[4] **Urbino Summer School in Paleoclimatology**. Urbino, Italy: *Do climate models underestimate the global temperature variability?* **Poster**. Jul 2018.

[3] **AGU Fall Meeting 2017**. New Orleans, LA: *Bridging the spectral divide: a case study with PAGES2k, the CESM Last Millennium Ensemble, and proxy system models.* **Poster**. Dec 2017.

[2] **Third Annual LMR Workshop**. Boulder, CO: *Bridging the spectral divide: a case study with PAGES2k, the CESM Last Millennium Ensemble, and proxy system models.* **Poster**. Oct 2017.

[1] **Joint Center of Satellite Data Assimilation Summer Colloquium**. Fort Collins, CO: *Why it is theoretically possible that an improved initial condition can degrade the forecast in fraternal-twin OSSEs?* **Talk**. Jul 2015.

Awards

Early Career Scholarship. The openDendro Bootcamp. Jan 2024.

Early Career Researcher Travel Award. WCRP Open Science Conference. Oct 2023.

Early Career Researcher Travel Award. Building Upon the EarthCube community workshop. Jun 2023.

Graduate Student Travel Award. CLIVAR Water Isotopes and Climate Workshop. Oct 2019.

Graduate Student Travel Award. Data Assimilation, Reanalyses and Proxy System Modeling in Paleoenvironmental Science 2nd Workshop. May 2019.

Graduate Student Travel Award. Urbino Summer School in Paleoclimatology. Jul 2018.

Graduate Student Fellowship. University of Southern California. Aug 2016.

Graduate Student Travel Award. Joint Center of Satellite Data Assimilation Summer Colloquium. Jul 2015.