Feng Tao, Ph.D.

Postdoctoral Associate
Department of Ecology & Evolutionary Biology
Cornell University, Ithaca, NY 14850, United States

Email: feng.tao@cornell.edu
Phone: +1 607 227 2877
Homepage: https://phxtao.github.io

EDUCATION

Ph.D. **Tsinghua University**, Department of Earth System Science, Beijing, China, 2023
Joint Ph.D. at Max Planck Institute for Biogeochemistry, Jena, Germany (2021–2022)

B.Sc. **Sun Yat-sen University**, School of Environmental Science and Engineering, *with Honors*, Guangzhou, China, 2018
Exchange at The University of Hong Kong, Hong Kong SAR, China (2016)

ACADEMIC APPOINTMENTS

2023– **Cornell University**, Ithaca, NY, United States
Schmidt AI4Science Postdoctoral Associate advised by Prof. Benjamin Z. Houlton, Department of Ecology & Evolutionary Biology
AI for scalable enhanced rock weathering to remove carbon dioxide

2018–2023 **Tsinghua University**, Beijing, China
Research Assistant of Profs. Yiqi Luo (at NAU/Cornell) & Xiaomeng Huang (at Tsinghua)
Soil carbon cycle study with data assimilation and deep learning

2021–2022 **Max Planck Institute for Biogeochemistry**, Jena, Germany
Joint Ph.D. student advised by Profs. Markus Reichstein & Marion Schrumpf
Global soil carbon sink using multi-source soil carbon (^{12}C/^{14}C) data

2019 **Food and Agriculture Organization of the United Nations**, Rome, Italy
Visiting Fellow of Global Soil Partnership (July - September)
Global soil organic carbon sequestration potential mapping

2017 **University of British Columbia**, Vancouver, Canada
Research Assistant of Dr. Heather Trajano (June - September)
Microbial Fuel Cells (MFC)

RESEARCH INTERESTS

Soil organic carbon: formation, stabilization, and responses to climate change

Enhanced rock weathering for scalable carbon dioxide removal

Artificial intelligence (AI) for mechanism discovery in biogeochemistry

GRANTS AND AWARDS

Awards and Honors

2023 27th "Xueshu Xinxiu" (Ten Outstanding Graduate Researchers) of Tsinghua University

2023 Honors PhD Graduate of Tsinghua University

2023 Outstanding PhD Thesis of Tsinghua University

2023 Best Student Paper Award of Sino-Ecologists Association Overseas (Sino-Eco) for the paper *Microbial carbon use efficiency promotes global soil carbon storage* (Nature)

2021 Early Career ISMC (International Soil Modelling Consortium) Presentation Award

2018 Honors Bachelor Graduate of Sun Yat-sen University

2018 Outstanding Bachelor Thesis of Sun Yat-sen University

Fellowships

2023– Schmidt AI in Science Postdoc Fellowships at Cornell University, funded by Schmidt Futures

2020 Chinese Government Scholarship, as visiting PhD student, funded by China Scholarship Council

2019 International Organization Internship, funded by China Scholarship Council

2017 Third Class Scholarship of Sun Yat-sen University

2017 Mitacs Globalink Research Internship Award, funded by Mitacs of Canada and China Scholarship Council

2017 Fung Scholarship (HKU), funded by Victor and William Fung Foundation Limited

2016 First Class Scholarship of Sun Yat-sen University

2016 China National Scholarship, awarded by Ministry of Education of P. R. China

2015 First Class Scholarship of Sun Yat-sen University

2015 China National Scholarship, awarded by Ministry of Education of P. R. China

PUBLICATIONS

First-Authored Journal Articles

2024 **Tao, F.**, B. Z. Houlton, Y. Huang, Y.-P. Wang, S. Manzoni, B. Ahrens, U. Mishra, L. Jiang, X. Huang, and Y. Luo. 2024. Convergence in simulating global soil organic carbon by structurally different models after data assimilation, *Global Change Biology*, Accepted.

2024 **Tao, F.**, J. Lehmann, Y.-P. Wang, L. Jiang, B. Ahrens, K. Viatkin, S. Manzoni, B. Z. Houlton, Y. Huang, X. Huang, and Y. Luo. 2024. Reply to "Beyond microbial carbon use efficiency", *National Science Review*, Volume 11, Issue 4, April 2024, nwae058, https://doi.org/10.1093/nsr/nwae058

2024 **Tao, F.**, B. Z. Houlton, S. D. Frey, J. Lehmann, S. Manzoni, Y. Huang, L. Jiang, U. Mishra, B. A. Hungate, M. W. I. Schmidt, M. Reichstein, N. Carvalhais, P. Ciais, Y.-P. Wang, B. Ahrens, G. Hugelius, T. D. Hocking, X. Lu, Z. Shi, K. Viatkin, R. Vargas, Y. Yigini, C. Omuto, A. A. Malik, G. Peralta, R. Cuevas-Corona, L. E. Di Paolo, I. Luotto, C. Liao, Y.-S. Liang, V. S. Saynes, X. Huang, and Y. Luo. 2024 Reply to: Model uncertainty obscures major driver of soil carbon. *Nature* 627, E4-E6 (2024). https://doi.org/10.1038/s41586-023-07000-9

2024 **Tao, F.**, and B. Z. Houlton. 2024 Inorganic and organic synergies in enhanced weathering to promote carbon dioxide removal. *Global change biology* 30:e17132.

2023 **Tao, F.**, Y. Huang, B. A. Hungate, S. Manzoni, S. D. Frey, M. W. I. Schmidt, M. Reichstein, N. Carvalhais, P. Ciais, L. Jiang, J. Lehmann, Y.-P. Wang, B. Z. Houlton, B. Ahrens, U. Mishra, G. Hugelius, T. D. Hocking, X. Lu, Z. Shi, K. Viatkin, R. Vargas, Y. Yigini, C. Omuto, A. A. Malik, G. Peralta, R. Cuevas-Corona, L. E. Di Paolo, I. Luotto, C. Liao, Y.-S. Liang, V. S. Saynes, X. Huang, and Y. Luo. 2023. Microbial carbon use efficiency promotes global soil carbon storage. *Nature* 618, 981-985 (2023). https://doi.org/10.1038/s41586-023-06042-3

2019 **Tao, F.**, Z. Zhou, Y. Huang, Q. Li, X. Lu, S. Ma, X. Huang, Y. Liang, G. Hugelius, L. Jiang, R. Doughty, Z. Ren, and Y. Luo. 2019. Deep Learning Optimizes Data-Driven Representation of Soil Organic Carbon in Earth System Model Over the Conterminous United States. *Frontiers in Big Data*, 3(17). https://doi.org/10.3389/fdata.2020.00017

Co-Authored Journal Articles

2023 Liao, C., X. Lu, Y. Huang, **F. Tao**, D. M. Lawrence, C. D. Koven, K. W. Oleson, W. R. Wieder, E. Kluzek, X. Huang, and Y. Luo. 2023. Matrix Approach to Accelerate Spin-Up of CLM5. *Journal of Advances in Modeling Earth Systems*, 15(8), e2023MS003625. https://doi.org/https://doi.org/10.1029/2023MS003625

2023 Ma, S., L. Jiang, R. M. Wilson, J. Chanton, S. Niu, C. M. Iversen, A. Malhotra, J. Jiang, Y. Huang, X. Lu, Z. Shi, **F. Tao**, J. Liang, D. Ricciuto, P. J. Hanson, and Y. Luo. 2023. Thermal acclimation of plant photosynthesis and autotrophic respiration in a northern peatland. *Environmental Research: Climate*, 2(2), 025003. https://doi.org/10.1088/2752-5295/acc67e

2023 Hou, E., S. Ma, Y. Huang, Y. Zhou, H.-S. Kim, E. López-Blanco, L. Jiang, J. Xia, **F. Tao**, C. Williams, M. Williams, D. Ricciuto, P. J. Hanson, and Y. Luo. 2023. Across-model spread and shrinking in predicting peatland carbon dynamics under global change. *Global change biology* 29:2759-2775.

2022 Liao, C., W. Huang, J. Wells, R. Zhao, K. Allen, E. Hou, X. Huang, H. Qiu, **F. Tao**, L. Jiang, M. Aguilos, L. Lin, X. Huang, and Y. Luo. 2022. Microbe-iron interactions control lignin decomposition in soil. *Soil Biology and Biochemistry* 173:108803.

2022 Luo, Y., Y. Huang, C. A. Sierra, J. Xia, A. Ahlström, Y. Chen, O. Hararuk, E. Hou, L. Jiang, C. Liao, X. Lu, Z. Shi, B. Smith, **F. Tao**, and Y.-P. Wang. 2022. Matrix approach to land carbon cycle modeling. *Journal of Advances in Modeling Earth Systems*:e2022MS003008.

2022 Liao, C., W. Huang, J. Wells, R. Zhao, K. Allen, E. Hou, X. Huang, H. Qiu, **F. Tao**, L. Jiang, M. Aguilos, L. Lin, X. Huang, and Y. Luo. 2022. Microbe-iron interactions control lignin decomposition in soil. *Soil Biology and Biochemistry* 173:108803.

2021 Zhang, Z., H. Zhang, Z. Cui, **F. Tao**, Z. Chen, Y. Chang, V. Magliulo, G. Wohlfahrt, and D. Zhao. 2021. Global consistency in response of terrestrial ecosystem respiration to temperature. *Agricultural and forest meteorology* 308-309:108576.

2018 Zhang, Z., W. Wang, J. Qi, H. Zhang, **F. Tao**, and R. Zhang. 2019. Priming effects of soil organic matter decomposition with addition of different carbon substrates. *Journal of Soils and Sediments* 19:1171-1178.

2018 Zhang, Z., R. Zhang, Y. Zhou, A. Cescatti, G. Wohlfahrt, M. Sun, H. Zhang, J. Qi, J. Zhu, V. Magliulo, **F. Tao**, and G. Chen. 2018. A temperature threshold to identify the driving climate forces of the respiratory process in terrestrial ecosystems. *European Journal of Soil Biology* 89:1-8.

Book Chapters

2022 **Tao, F.**. Bayesian statistics and Markov chain Monte Carlo method in data assimilation. In Y. Luo & B. Smith (Eds.), *Land Carbon Cycle Modeling: Matrix Approach, Data Assimilation, and Ecological Forecasting*. Taylor and Francis.

2022 **Tao, F.**, and Y. Luo. PROcess-guided deep learning and DAta-driven modelling (PRODA). In Y. Luo & B. Smith (Eds.), *Land Carbon Cycle Modeling: Matrix Approach, Data Assimilation, and Ecological Forecasting*. Taylor and Francis.

2022 **Tao, F.**. Practice 10, Deep learning to optimize parametrization of CLM5. In Y. Luo & B. Smith (Eds.), *Land Carbon Cycle Modeling: Matrix Approach, Data Assimilation, and Ecological Forecasting*. Taylor and Francis.

PRESENTATIONS

2023 **Tao, F.**, Y. Huang, B. A. Hungate, S. Manzoni, S. D. Frey, M. W. I. Schmidt, M. Reichstein, N. Carvalhais, P. Ciais, L. Jiang, J. Lehmann, Y.-P. Wang, B. Z. Houlton, B. Ahrens, U. Mishra, G. Hugelius, T. D. Hocking, X. Lu, Z. Shi, K. Viatkin, R. Vargas, Y. Yigini, C. Omuto, A. A. Malik, G. Peralta, R. Cuevas-Corona, L. E. Di Paolo, I. Luotto, C. Liao, Y.-S. Liang, V. S. Saynes, X. Huang, and Y. Luo. Microbial carbon use efficiency promotes global soil carbon storage. 2023 AGU Fall Meeting, 11-15 December 2023, San Francisco, CA, Poster.

2023 **Tao, F.**, B. Z. Houlton, Y. Huang, Y.-P. Wang, S. Manzoni, B. Ahrens, U. Mishra, L. Jiang, X. Huang, and Y. Luo. 2024. Convergence in simulating global soil organic carbon by structurally different models after data assimilation, 2023 AGU Fall Meeting, 11-15 December 2023, San Francisco, CA, Poster.

2023 **Tao, F.**. Microbial carbon use efficiency promotes global soil carbon storage. CCBB Journal Club. September 29, 2022, Tennessee State University via Zoom.

2023 **Tao, F.**. Microbial carbon use efficiency promotes global soil carbon storage. Sino-Eco Talks. July 10, 2022, via Zoom.

2022 **Tao, F.**, Ahrens, B., Yang, H., Schrumpf, M., Carvalhais, N., Reichstein, M., Huang, X. and Luo, Y., 2022. Historical fate of global soil organic carbon in the past century. 2022 AGU Fall Meeting. 12 - 16 December 2022, Chicago, USA, Talk.

2022 **Tao, F.** and Luo, Y., Quantifying soil carbon sequestration by multi-source constraints. 2022 EGU Meeting, 23 - 27 May 2022, Vienna, Austria, Talk (highlighted)

2021 **Tao, F.** and Luo, Y., Using Multi-source Constraints to Quantify Soil Carbon Sequestration. 2021 AGU Fall Meeting, 13 - 17 December 2021, Virtual, Poster

2021 **Tao, F.**, Huang, Y., Hungate, B., Lu, X., Hocking, T. D., Mishra, U., Hugelius, G., Huang, X., Luo, Y., PROcess-guided deep learning and DAta-driven modelling (PRODA) to uncover key patterns and mechanisms in global soil carbon cycle at OOS 25: Using Machine Learning to Quantify and Improve Earth System Predictions, 2021 ESA Annual Meeting, 2 - 6 August 2021, Virtual, Talk

2021 **Tao, F.** and Luo, Y., PROcess-guided deep learning and DAta-driven modelling (PRODA) uncovers key mechanisms underlying global soil carbon storage, 2021 3rd ISMC Conference, 18 - 22 May 2021, Virtual, Invited Talk, Highlights Talk

2021 **Tao, F.** and Luo, Y., Big data-driven modelling in CLM5 reveals microbial carbon use efficiency as the key mechanism underlying global soil organic carbon storage, 2021 NCAR CESM Land Model and Biogeochemistry Working Group Meeting, 23 - 25 February 2021, Virtual, Talk

2020 **Tao, F.**, Huang, X., Mishra, U., Hugelius, G. and Luo, Y., Big data-driven modelling reveals key mechanisms underlying soil organic carbon stabilization. 2020 AGU Fall Meeting, 1 - 17 December 2020, Virtual, Talk

2020 **Tao, F.**, Huang and Luo, Y., Deep learning and constrained modelling from big data jointly reveal key mechanisms in soil organic carbon stabilization at Symposium SYMP7: Combining Deep Learning and Process-Based Modeling to Advance Ecological Forecasting. 2020 ESA Annual Meeting, 3 - 6 August 2020, Virtual, Invited Talk

2020 **Tao, F.**. Improving representation of soil organic carbon: process-guided data driven deep learning modeling. 3rd Training Course on New Advances in Land Carbon Cycle Modeling, 21 - 30 July 2020, Virtual meeting hosted by Northern Arizona University, Flagstaff, Arizona, USA. Talk.

2019 **Tao, F.**., Zhou, Z., Huang, Y., Li, Q., Lu, X., Ma, S., Huang, X., Liang, Y., Hugelius, G., Jiang, L., Doughty, R., Ren, Z. and Luo, Y., Deep learning optimizes data-driven representation of soil organic carbon in Earth system model over the conterminous United States. 2019 AGU Fall Meeting, 9 - 13 December 2019, San Francisco, USA. Poster

2019 **Tao, F.**, Soil organic carbon sequestration potential: process-oriented model approach. 5th Working Session of the International Network of Soil Information Institutions (INSII), 21 - 23 October 2019, FAO Headquarters, Rome, Italy. Oral report on behalf of Global Soil Partnership (GSP) secretariat of FAO.

2018 **Tao, F.**, Luo, Y., Zhou, Z., Huang, Y., Big-data-big-model fusion to improve prediction of global soil carbon dynamics with Earth System Model. 2018 AGU Fall Meeting, 10 - 14 December 2018, Washington, D.C., USA. Poster

SERVICES

Academic Journal Peer Review

Review papers for *Global Change Biology* (GCB), *GCB-Bioenergy*, *New Phytologist*, *Journal of Advances in Modeling Earth Systems* (JAMES), *Scientific Data*, *Ecological Processes*, *Soil Science Society of America Journal*, *Catena*

Mentorship

Natalia Butler (2024), Ph.D. student at Cornell, on ten-week rotation training on modeling enhanced rock weathering in Houlton Lab

Haodi Xu (2023–), Ph.D. student at Luo Lab at Cornell, on Biogeochemistry-Informed Neural Network

TEACHING

Cornell University

Two-week Training Course on New Advances in Land Carbon Cycle Modeling, as Lecturer and Instructor (2022–)

Northern Arizona University

Two-week Training Course on New Advances in Land Carbon Cycle Modeling, as Lecturer and Instructor (2019–2021)

Tsinghua University

Ecological Modelling, as Guest Lecturer (2021–2022)

ADDITIONAL INFORMATION

Languages: Mandarin (Native), English (IELTS 7.0), German (Basic)

Programming: Proficient at MATLAB, R and Python. Familiar with Fortran (MPI)

Laboratory Skills: Laboratory skills in chemical and biological analysis. e.g. HPLC, XRD, SEM, etc.