Feng Tao, Ph.D.

Nanyang Assistant Professor
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EDUCATION

Ph.D. **Tsinghua University**, Department of Earth System Science, *with Honors*, Beijing, China, 2023
Joint Ph.D. at Max Planck Institute for Biogeochemistry, Jena, Germany (Sept 2021–Dec 2022)
Dissertation: *Mechanisms and Predictions of Global Soil Carbon Storage Based on Data Assimilation and Deep Learning*

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 (Sept–Dec 2016)

EMPLOYMENT

2026– **Nanyang Assistant Professor**
The Asian School of the Environment, Nanyang Technological University, Singapore

2025–2026 **Assistant Professor**
Department of Informatics and Intelligent Systems, Institute of Energy and the Environment (co-hire), The Pennsylvania State University, University Park, PA, United States

2023–2025 **Eric & Wendy Schmidt AI in Science Postdoctoral Fellow**
Department of Ecology & Evolutionary Biology, Cornell University, Ithaca, NY, United States
AI for scalable enhanced rock weathering to remove carbon dioxide

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

ACADEMIC EXPERIENCE

2018–2023 **Tsinghua University**, Beijing, China
Research Assistant of Profs. Yiqi Luo (at Northern Arizona University/Cornell University) & Xiaomeng Huang (at Tsinghua University)
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

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

RESEARCH INTERESTS

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

Enhanced rock weathering for scalable carbon dioxide removal

Interpretable AI for scientific discoveries

Process-guided foundation model in biogeochemistry

GRANTS AND AWARDS

Grants

2026-2031 Nanyang Assistant Professorship, Nanyang Technological University, on "Process-guided AI-assisted Soil Carbon foundAtion (PASCA) Model for Verifiable Carbon Dioxide Removal by Enhanced Rock Weathering"

2026-2027 2026 IEE Seed Grant Program, Penn State University (co-PI with O. Apul & C. Anderson at Penn State), on "Unraveling Molecular Level Interactions between Per- and Polyfluoroalkyl Substances (PFAS) and Plant Tissues via Process Guided AI towards Advancing Phytoremediation at Sites Impacted by Aqueous Film Forming Foam (AFFF)" (did not take due to relocation)

2023-2025 Eric & Wendy Schmidt AI in Science Postdoctoral Fellowship, Cornell University, on "Process-guided AI for scalable enhanced rock weathering toward global carbon neutrality"

Awards

2026 Nanyang Assistant Professorship, Nanyang Technological University

2025 Outstanding PhD Thesis in Beijing Region for the year of 2024

2023 Eric & Wendy Schmidt AI in Science Postdoctoral Fellowship

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 paper *Microbial carbon use efficiency promotes global soil carbon storage* (Nature)

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

2020 Exchange Scholarship, funded by China Scholarship Council

2019 International Organization Internship, funded by China Scholarship Council

2018 Honors Bachelor Graduate of Sun Yat-sen University

2018 Outstanding Bachelor Thesis of Sun Yat-sen University

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 (at 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

Google Scholar: https://scholar.google.com/citations?user=BlNzWiUAAAAJ
* Correspondence author; † Co-first author

Work in Progress

Tao, F.*, B. Z. Houlton, X. Huang, and Y. Luo. Deep soil carbon sequestration limited by low plant input. ***under review***

Ding, M., **Tao, F.**†, X. Lu, J. Yan, J. Liu, Y.P. Wang, Y. Luo, D. Wu. Persistent yet vulnerable soil carbon sequestration in China's forests under climate change. ***under review***

Selected Publications

2026 **Tao, F.*** and B. Z. Houlton (2026). Optimizing carbon dioxide removal in agricultural soils: A new mechanistic model of enhanced rock weathering. ***Journal of Advances in Modeling Earth Systems***, accepted.
A new model that couples multi-pool soil organic carbon decomposition with weathering-driven soil inorganic formation and represents their interactions with soil chemistry, biology, and management.

2026 Xu, H., J. Fan, **F. Tao*** †, L. Jiang, F. You, B. Z. Houlton, Y. Sun, C. Gomes, and Y. Luo (2026). A Biogeochemistry-Informed Neural Network (BINN) for Mechanism Discoveries in Soil Carbon Cycle. ***Geoscientific Model Development***, https://doi.org/10.5194/gmd-19-6777-2026
An end-to-end deep learning framework mapping environmental covariates to biogeochemical parameters in a process-based model for efficient, multi-objective optimization with proven causal inference capacity.
Media Highlights: Cornell Chronicle

2026 Fan, J., H. Xu, **F. Tao**†, *, M. Nasim, M. Grimson, Y. Luo, C. Gomes. (2026). Scientifically-Interpretable Reasoning Network (ScIReN): Discovering Hidden Relationships in the Carbon Cycle and Beyond, ***Proceedings of the AAAI Conference on Artificial Intelligence***, https://doi.org/10.1609/aaai.v40i45.41185
Leveraging Kolmogorov-Arnold networks (KANs) to reveal interpretable relationships between input features and biogeochemical parameters in process-based models, transforming deep learning from black-box to transparent-box for scientific interpretability.

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
The first study to measure the relative importance of microbial processes in the soil carbon cycle at the global scale. The role microbes play in storing soil organic carbon is at least four times more important than any other process, including decomposition of biomatter and plant input.
Media Highlights: Phys.org, TechnologyNetworks, Cornell Chronicle, VBiO (German), Forskning.se (Swedish), Science & Technology Daily (Chinese), Tsinghua News (Chinese)
Best Student Paper of Sino-Ecologists Association Overseas (Sino-Eco) 2023

2020 **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. (2020). 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
One of the first papers fusing deep learning with process-based model to understand soil carbon cycle.

Other Peer-reviewed Journal Articles

2026 Zhou, J., Q. Quan, W. Huang, P. J. Hanson, D. Ricciuto, M. A. Mayes, N. A. Griffiths, V. G. Salmon, S. E. Weber, J. M. Warren, R. J. Norby, M. Y. McPartland, M. E. Dusenge, D. Way, L. Jiang, Y. Zhou, H. Xu, **F. Tao**, X. Shi, W. Chen, Y. Zhang, and Y. Luo (2026). Elevated CO_2 mitigated warming-enhanced carbon loss from northern peatland. ***Science Advances***, 12(44), eaek1491. https://doi.org/10.1126/sciadv.aek1491

2026 Wang, C., L. Xue, P. B. Reich, J. Peñuelas, **F. Tao**, Y. Kuzyakov (2026), Limited energy for microorganisms constrains carbon accrual in soil. ***Nature Geoscience*** https://doi.org/10.1038/s41561-026-02035-9
Global evidence showing that energy is a critical limitation in soil microbial metabolism, restricting microbial growth and ultimately soil carbon accrual

2026 Hui, D., S. Wan, T. Zhou, J. Xia, **F. Tao**, Y. Huang, J. Chen, X. Lu, C. Liao, Z. Du, X. Zhou, S. Niu, Y. Luo (2026), Advancing ecosystem ecology through innovative research methods and techniques. ***Frontiers of Earth Science*** https://doi.org/10.1007/s11707-026-1222-6

2026 Sun, S., M. F. Cotrufo, R. A. Viscarra Rossel, C. W. Mueller, M. Kida, A. G. Hardie, A. Mackay, A. H. Krichels, W. Amelung, A. Kumar, A. Suleymanov, B. Shi, B. J. Cosby, C. Plaza, C. Terrer, C. Liang, C. Liao, C. Just, D. Guo, E. Lugato, E. Hou, F. Ding, F. Zhao, **F. Tao**, F. T. Maestre, F. Bilotto, F. Wu, G. V. García, G. Luo, G. Han, G. A. Studdert, G. Hernandez-Ramirez, G. Niu, G. Piñeiro, G. Saiz, H. Zhang, H. Abdelrahman, H. Xu, I. Lebron, I. Kurganova, J. Blesh, J. Å. Kristensen, J. Liu, J. Zhou, J. Wu, J. Ahirwal, J. Cao, J. E. Olesen, K. Kauer, K. Georgiou, K. J. van Groenigen, K. Van Oost, K. A. Frimpong, L. Deng, L. G. Benning, L. Guo, L. Mujuru, M. Delgado-Baquerizo, M. Dor, M. Rahmati, M. Luo, O. Kalinina, O. Hyvärinen, P. García-Palacios, P. Hansen, P. Rounak, P. Duan, P. Zhao, P. M. Homyak, R. Ghimire, R. Žydelis, R. Bol, R. Vibart, R. Chang, R. Luo, S. Villarino, S. Xue, S. Niu, S. Chen, T. Yu, S. J. Hall, T. Kätterer, T. Ge, V. E. Mbanjwa, V. M. Semenov, W. Liu, W. Shi, W. Zhang, W. Wanek, W. Buss, X. Cheng, X. Lu, X. Shi, X. Cheng, X. Wei, X. Liu, X. Zhou, Y. Kooch, Y. Zhong, Y. Cai, Y. Yang, Y. Luo, Y. Zhang, Y. Qin, Y. Fang, Y. Liang, Y. Li, Z. Chen, Z. Liu, Z. Song, Z. Luo, Z. An and J. Chen (2026). Global hotspots of particulate organic carbon losses under climate change. ***Nature Communications***. https://doi.org/10.1038/s41467-026-71321-2.

2026 Gang C., N. Wei, C. Feng, H. Xu, H. Liu, **F. Tao**, L. Jiang, J. Xia, S. Sitch, Y. Luo. ***Communications Earth & Environment*** https://doi.org/10.1038/s43247-026-03312-6

2026 Tu, Y., R. Rafols, Y. Xu, N. Butler, L. Ababneh, **F. Tao**, V. Ramanathan, B. Z Houlton, C. Liao. (2026). Scaling up enhanced rock weathering for equitable climate change mitigation. ***Communications Sustainability***. https://doi.org/10.1038/s44458-026-00034-w

2026 Hu, J., Z. Huang, Z. Sun, X. Song, Y. Huang, K. Zamanian, **F. Tao**, F. Yang, H. Wen, and G. Zhang. (2026). Climate change leads to significant loss of soil inorganic carbon. ***National Science Review***. https://doi.org/10.1093/nsr/nwag075

2026 Cui, Y., S. Peng and M. Delgado-Baquerizo, D. L. Moorhead, R. L. Sinsabaugh, C. Terrer, T. P. Smith, Y. Kuzyakov, J. Peñuelas, B. Zhu, **F. Tao**, S. Hong, J. Chen, M. C. Rillig (2026). Productivity-driven decoupling of microbial carbon use efficiency and respiration across global soils. ***Science Advances***. https://doi.org/10.1126/sciadv.adz5319

2025 Luo, Y., N. Wei, X. Lu, Y. Zhou, **F. Tao**, Q. Quan, C. Liao, L. Jiang, J. Xia, Y. Huang, S. Niu, X. Xu, Y. Sun, N. Zeng, C. Koven, L. Peng, S. Davis, P. Smith, F. You, Y. Jiang, L. Cheng and B. Houlton (2025). Large CO2 removal potential of woody debris preservation in managed forests. ***Nature Geoscience***. https://doi.org/10.1038/s41561-025-01731-2
Theoretical test of burying wood in soils as a scalable carbon dioxide removal method.

Media Highlights: Science Blog, Phys.org, Cornell Chronicle

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***, 30(5), e17297. https://doi.org/https://doi.org/10.1111/gcb.17297

2024 Huang, Y., X. Song, Y.-P. Wang, J. G. Canadell, Y. Luo, P. Ciais, A. Chen, S. Hong, Y. Wang, **F. Tao**, W. Li, Y. Xu, R. Mirzaeitalarposhti, H. Elbasiouny, I. Savin, D. Shchepashchenko, R. A. V. Rossel, D. S. Goll, J. Chang, B. Z. Houlton, H. Wu, F. Yang, X. Feng, Y. Chen, Y. Liu, S. Niu, and G.-L. Zhang. 2024. Size, distribution, and vulnerability of the global soil inorganic carbon. ***Science*** 384:233-239. https://doi.org/doi:10.1126/science.adi7918
A global assessment of soil inorganic carbon storage and its vulnerability to climate change.
Media Highlights: Phys.org, The Conversation, People's Daily

2024 Nyaupane, K., U. Mishra, **F. Tao**, K. Yeo, W. J. Riley, F. M. Hoffman, and S. Gautam. 2024. Observational benchmarks inform representation of soil organic carbon dynamics in land surface models. ***Biogeosciences*** 21:5173-5183. https://doi.org/10.5194/bg-21-5173-2024

2024 He, X., E. Asb, S. Allison, **F. Tao**, Y. Huang, S. Manzoni, R. Abramoff, E. Bruni, S. Bowring, A. Chakrawal, P. Ciais, L. Elsgaard, P. Friedlingstein, K. Georgiou, G. Hugelius, L. B. Holm, W. Li, Y. Luo, G. Marmasse, N. Nunan, C. Qiu, S. Sitch, Y.-P. Wang, and D. Goll. 2024. Emerging multiscale insights on microbial carbon use efficiency in the land carbon cycle, ***Nature Communications***, 15(1), 8010. https://doi.org/10.1038/s41467-024-52160-5

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. https://doi.org/10.1111/gcb.17132

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.**, 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.**. 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.**. 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

Invited Talks/Seminars

2026 RUBISCO SOC WG Webinar

Chinese University of Hong Kong (invited by Dr Zherong Wu)

Cascade Climate ERW Modeler-Empiricist Workshop

2025 Fudan University (invited by Dr Zimeng Wang)

Center for Eco-Environmental Sciences, Chinese Academy of Sciences (invited by Dr Keying Xiao)

China Agriculture University (invited by Dr Huadong Zang)

Woodwell Climate Research Center (invited by Dr Elchin Jafarov)

Yale Center for Natural Carbon Capture (YCNCC) Spring 2025 Symposium

Climate Change AI (CCAI) Discussion Seminar Series #6 (invited by Ivan Poon)
Recorded video available

2024 University of Zurich (invited by Prof. Michael W. I. Schmidt)

Institute of Earth Environment, Chinese Academy of Sciences (invited by Dr Ji Chen)

Sun Yat-sen University (invited by Dr Haicheng Zhang)

South China Botanical Garden, Chinese Academy of Sciences (invited by Dr Donghai Wu)

Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (invited by Dr Yuanyuan Huang)

RUBISCO SOC WG Monthly Webinar (invited by Dr Umakant Mishra)

2023 Tennessee State University CCBB Journal Club (invited by Prof Jianwei Li)

Cornell University (invited by Prof. Fengqi You)

South China Botanical Garden, Chinese Academy of Sciences (invited by Dr Donghai Wu)

Sino-Eco

2022 RUBISCO SOC WG Monthly Webinar (invited by Dr Umakant Mishra)

Conference Presentations

2025 **Tao, F.**, H. Xu, J. Fan, Y. Luo, C. Gomes, B. Z. Houlton. Process-guided and AI-assisted Soil Carbon Foundation Model for Natural Climate Solutions. AGU2025, 15-19 December 2025, New Orleans, LA.

2025 **Tao, F.** & Y. Luo. Microbial carbon use efficiency promotes global soil carbon storage. ESA2025, 10-15 August 2025, Baltimore, MD, Invited Talk.

2025 **Tao, F.**. Deep soil carbon sequestration limited by plant input. AOGS2025, 27 July-1 August 2025, Singapore, Talk.

2025 **Tao, F.** and B. Z. Houlton. Key limitations in enhanced rock weathering to promote carbon dioxide removal. EGU25, 27 April-2 May 2025, Vienna, Austria, Talk.

2024 **Tao, F.** Y. Luo, X.Huang, and B. Z. Houlton. Deep soil carbon sequestration limited by low plant input. 2024 AGU Fall Meeting, 9-13 December 2024, Washington DC, Talk.

2024 **Tao, F.** and B. Z. Houlton. Coupling soil inorganic-organic carbon dynamics for verifiable carbon dioxide removal by enhanced weathering. 2024 Goldschmidt Conference, 18-23 August 2024, Chicago, IL, Talk.

2024 **Tao, F.** and B. Z. Houlton. A modeling approach to explore key mechanisms in enhanced weathering to promote carbon dioxide removal. 2024 ESA Annual Meeting, 4-9 August 2024, Long Beach, CA, Talk.

2024 **Tao, F.** and B. Z. Houlton. A Modeling Approach to Explore Inorganic and Organic Synergies in Enhanced Weathering to Promote Carbon Dioxide Removal. AOGS2024 21st Annual Meeting, 23-28 June 2024, Pyeongchang, Gangwon-do, South Korea, Talk.

2024 **Tao, F.** Convergence in simulating global soil organic carbon by structurally different models after data assimilation, 4th Annual Land Data Assimilation Community Virtual Workshop, 24-25 June, 2024, Virtual, Talk.

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.

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

International Leadership

2025–2028 Early Career Representative of the Scientific Steering Committee, AIMES (Analysis, Integration, and Modeling of the Earth System) Land Data Assimilation Working Group

Guest Editor

2026 *The Innovation Geoscience*, Virtual Collection: "Microbial Carbon and Nutrient Use Efficiency under Global Change". Co-Guest Editor with Drs Ji Chen, Jiacong Zhou, Chao Wang, Kailiang Yu, and Decai Gao.

2025 *Biogeochemistry*, Topical Collection: "Advances in land carbon cycle modeling". Leading Guest Editor with Drs Lifen Jiang, and Bailey Murphy.

2025 *Agriculture, Ecosystems & Environment*, Special Issue: "How agriculture managements influence biogeochemical cycles of soil carbon: processes, mechanisms and ecological consequences". Co-Guest Editor with Drs Xiaodong Song, Wenxiu Zou, and Jinsong Wang.

Academic Journal Peer Review

Review papers for *Science*, *Science Advances*, *Nature Geoscience*, *Nature Reviews Earth & Environment*, *Nature Communications*, *PNAS*, *Global Change Biology* (GCB), *Environmental Science & Technology*, *Soil Ecology Letters*, *GCB-Bioenergy*, *New Phytologist*, *Advanced Science*, *Soil Biology & Biochemistry*, *Journal of Advances in Modeling Earth Systems* (JAMES), *JGR: Biogeosciences*, *Scientific Data*, *Communications Earth and Environment*, *Ecological Processes*, *Soil Science Society of America Journal*, *Catena*, *Soil Use and Management*

Other Review

U.S.-Israel Binational Science Foundation (2026)

Environment and Sustainability Honors Thesis Review, Cornell University (2024)

Conference Sessions

2026 **Tao, F.**, B. Murphy, X. Luo, & Z. Wu. Advances in land carbon cycle modeling, AGU Fall Meeting, 2026, San Francisco, CA

2026 **Tao, F.**, B. Z. Houlton, S. Redfern, U. Mishra, & Y. Zhang. Advances in Soil Carbon Sequestration: Processes, Management, and Scalable Storage, AGU Fall Meeting, 2026, San Francisco, CA

2025 **Tao, F.**, B. Murphy, & L. Jiang. Advances in land carbon cycle modeling, AGU Fall Meeting, 2025, New Orleans, LA

2025 **Tao, F.**, B. Z. Houlton, Y. Huang, & S. F. von Fromm. Soils in the Anthropocene, as a solution to climate change? Insights from empirical, modeling, and big data studies, AGU Fall Meeting, 2025, New Orleans, LA

2024 **Tao, F.**, Y. Luo, Y. Sun, A. Bastos, and B. Murphy. Advances in land carbon cycle modeling, AGU Fall Meeting, 2024, Washington, D.C.

2024 **Tao, F.**, B. Z. Houlton, Y. Huang, Y. Luo, S. F. von Fromm. Soils in the Anthropocene, as a solution to climate change? Insights from empirical, modeling, and big data studies, AGU Fall Meeting, 2024, Washington, D.C.

2024 **Tao, F.**, B. Z. Houlton, and Y. Luo. Soil as a solution to climate change: insights from empirical, modeling, and big data studies, ESA Annual Meeting, 2024, Long Beach

Mentorship

2026 Akshaya Shyamsundar Rekha, undergraduate student at Penn State, Honors Options, on AI carbon footprint

2025 Kevin Toepelt, undergraduate student at Cornell, on transfer learning

2023– Haodi Xu, Ph.D. student at Cornell (primary supervisor: Yiqi Luo), on Biogeochemistry-Informed Neural Network (BINN)

2023–2026 Joshua Fan, Ph.D. student at Cornell (primary supervisor: Carla P. Gomes), on Biogeochemistry-Informed Neural Network (BINN)

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

TEACHING

Penn State University

2026 Spring DS320 (3 credit), *Data Integration*

2026 Spring DS402 (3 credit), *Trend in Data Science: AI, Systems Modeling and Carbon*

Cornell University

2025 Spring *AI in Ecology, Biodiversity, & the Environment*, Graduate seminar (BioEE 7600-101, 1 credit), as Co-Instructor with Drs. Felipe Pacheco, Imanol Miqueleiz, and Sebastian Heilpern

2024 Fall *Global soil carbon cycle modeling and AI-aided new discoveries*, Graduate seminar (BioEE 7600-102, 1 credit), as Instructor

2022–2025 *New Advances in Land Carbon Cycle Modeling*, Two-week Training Course, as Lecturer and Instructor

Northern Arizona University

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

Tsinghua University

2021–2022 *Ecological Modelling*, as Guest Lecturer

ACADEMIC ADVISORS

Yiqi Luo (Ph.D.), Liberty Hyde Bailey Professor, Cornell University, **Xiaomeng Huang** (Ph.D.), Professor, Tsinghua University, **Benjamin Z. Houlton** (Postdoc), Ronald P. Lynch Dean, Professor, Cornell University

ADDITIONAL INFORMATION

Languages: Mandarin (Native), English (Proficient), German (Beginner)

Programming: Proficient at Python, MATLAB and R, Familiar with FORTRAN (Earth System Model Development and Parallel Computing)