

Yuan Tian

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Research focus

Computational seismology and scientific machine learning; numerical wave propagation, seismic monitoring and imaging, planetary seismology, and uncertainty-aware analysis of geophysical observations.

Education

PhD in Geophysics, University of Houston | 2020

Advisor: Yingcai Zheng. Dissertation: Investigation of tidal-seismic resonance using 3-D boundary element method.

BS in Geophysics, University of Science and Technology of China | 2014

Advisor: Haijiang Zhang. Thesis research: fault-zone imaging using earthquake waveforms and seismic interferometry.

Research appointments and experience

University of California, Berkeley | January 2026–present

Assistant Project Scientist

- Develop and benchmark Distributional Finite-Difference Method (DFDM) solvers for seismic wave propagation, including a high-performance C++ implementation and comparisons with spectral-element methods.

Lawrence Livermore National Laboratory | September 2023–January 2026

Postdoctoral Research Staff

- Developed an elastic-wave sensitivity-based seismic survey design framework for monitoring geological carbon storage through the National Risk Assessment Partnership.
- Applied machine learning to airborne magnetic-anomaly data for detection and characterization of undocumented orphaned wells.

University of Alaska Fairbanks, Geophysical Institute | August 2020–September 2023

Postdoctoral Researcher

- Simulated Nenana Basin seismic wave amplification using SPECFEM3D, SeisFlows, and PySEP; compared observed and modeled wavefields.
- Developed and tested low-memory triggering approaches and terrestrial seismicity analogs for Venus seismometer design with NASA Glenn collaborators.
- Applied machine learning to remote-sensing data, including vegetation-water-content estimation and collaborative forest-disturbance mapping.

University of Houston, Earth and Atmospheric Sciences | September 2015–June 2020

Research Assistant, advisor Yingcai Zheng

- Developed AstroSeis, a 3-D boundary-element code for seismic wavefields in irregular bodies, and investigated tidal-seismic resonance and its effect on satellite orbital evolution.

University of Science and Technology of China | June 2013–July 2015

Research Assistant, advisor Haijiang Zhang

- Used seismic migration and interferometry to image fault-zone discontinuities; studied the Krafla geothermal field with double-difference tomography.

Industry experience

RevoChem LLC — Data Scientist Intern, June–August 2019. Developed a Python graphical toolkit for blob detection and information extraction from oil and core chromatography data; contributed to compound-database development.

Peer reviewed publications

1. Tian, Y., Yang, X., Huang, L., Gao, K., Iyer, J., Vasyukivska, V., & Gasperikova, E. (2026). Elastic-wave sensitivity-guided adaptive seismic survey design for cost-effective monitoring of geological carbon storage. *International Journal of Greenhouse Gas Control*, 153, 104655.
doi.org/10.1016/j.ijggc.2026.104655
2. Tian, Y., & Tape, C. (2025). Analysis of seismic wave amplification in sedimentary basins using 3D wavefield simulations: Nenana Basin, central Alaska. *Journal of Geophysical Research: Solid Earth*, 130(12), e2025JB031559.
doi.org/10.1029/2025JB031559
3. Zwieback, S., Young-Robertson, J., Robertson, M., Tian, Y., Chang, Q., Morris, M., White, J., & Moan, J. (2024). Low-severity spruce beetle infestation mapped from high-resolution satellite imagery with a convolutional network. *ISPRS Journal of Photogrammetry and Remote Sensing*, 212, 412–421.
doi.org/10.1016/j.isprsjprs.2024.05.013
4. Feng, Y.-T., Bethel, B. J., Tian, Y., Dong, C.-M., Liang, J., Yao, Y.-L., Yuan, J., Chen, Y., Chen, S.-J., & Yu, Y. (2023). Marine heatwaves in the Gulf of Mexico 1983–2021: Statistics, recent intensifications, and threats on coral reefs. *Advances in Climate Change Research*, 14(4), 560–572.
doi.org/10.1016/j.accr.2023.08.006
5. Tian, Y., Herrick, R. R., West, M. E., & Kremic, T. (2023; online 2022). Mitigating power and memory constraints on a Venusian seismometer. *Seismological Research Letters*, 94(1), 159–171.
doi.org/10.1785/0220220085
6. Zhao, M., Tian, Y., Dong, N., Hu, Y., Tian, G., & Lei, Y. (2022). Spatial and temporal dynamics of habitat quality in response to socioeconomic and landscape patterns in the context of urbanization: A case in Zhengzhou City, China. *Nature Conservation*, 48, 185–212.
doi.org/10.3897/natureconservation.48.85179
7. Zheng, Y., & Tian, Y. (2021). Seismic wavefields in a planet and their influence on the satellite orbit. *Reviews of Geophysics and Planetary Physics*, 52(2), 205–210.
doi.org/10.19975/j.dqyxx.2020-014
8. Tian, Y., & Zheng, Y. (2020). AstroSeis: A 3D boundary element modeling code for seismic wavefields in irregular asteroids and bodies. *Seismological Research Letters*, 91(6), 3528–3538.
doi.org/10.1785/0220200145
9. Tian, Y., & Zheng, Y. (2020). Rapid falling of an orbiting moon to its parent planet due to tidal-seismic resonance. *Planetary and Space Science*, 182, 104796.
doi.org/10.1016/j.pss.2019.104796

Selected conference contributions

- Tian, Y., Awan, M., Soergel, D., Wu, W., & Romanowicz, B. (2026). The Distributional Finite Difference Method: An efficient approach for high-resolution global wavefield simulations. *Seismological Society of America Annual Meeting*, 17 April. Presenting author; oral session.
- Tian, Y., Yang, X., Iyer, J., & Trueblood, J. (2024). Machine learning analysis of magnetic anomalies for detection of undocumented orphaned wells. *IMAGE 2024, International Meeting for Applied Geoscience & Energy*.

Technical methods and tools

Numerical methods: boundary elements, finite differences, spectral-element modeling, seismic sensitivity analysis, normal modes, and inverse problems.

Programming and software: Python, C++, MATLAB, Fortran, Mathematica; PyTorch; SPECfem, SeisFlows, ObsPy, and PySEP; cluster and GPU computing.

Research software and current projects

DFDM for two dimensional elastic wave propagation

C++ solver development with MPI and OpenMP; waveform and computational-cost benchmarking against SPECfem2D. Manuscript in preparation.

Physics grounded neural operators for seismic wavefields

Developing physics-grounded neural operators and differentiable forward models for seismic wave propagation. Manuscripts in preparation.

MagYOLO for undocumented orphaned wells

Developing machine-learning methods for magnetic-anomaly detection and physical-parameter estimation, with uncertainty quantification. Manuscript in preparation.

AstroSeis boundary element modeling

Developed and benchmarked 3-D seismic modeling for irregular solid and acoustic bodies. Published in Seismological Research Letters (2020).

Selected research proposals

DOE University Training and Research | Principal Investigator | 2026

Characterizing Geothermal Fractures Beyond the Wellbore with DFDM and Borehole Seismic Sensing. DE-FOA-0003215; letter of intent submitted 1 October 2026; full proposal in preparation.

National Science Foundation | Principal Investigator | 2026

The distributional finite difference method: further optimization and application to imaging fine-scale structure in the deep mantle. Proposal 2641482; full proposal submitted 1 September 2026.

DOE Genesis Mission | Principal Investigator | 2026

AI-Driven Problem-to-Code Implementation and Optimization of the Distributional Finite Difference Method for High Performance Wave Propagation Simulations. DE-FOA-0003612; designated an alternate on 23 July 2026; not selected for award at that time.

DOE TCF CLIMR | Principal Investigator at LLNL | FY25

Machine Learning-Driven Autonomous Workflow for UAV Magnetic Data Processing and Interpretation. FY25 Technology Commercialization Fund, Core Laboratory Infrastructure for Market Readiness Lab Call (DE-LC-000L124). Concept paper encouraged; control L124-1703.

Teaching experience

University of Alaska Fairbanks

- GEOS 627, Inverse Problems and Parameter Estimation (Spring 2022): developed computational homework and laboratory exercises.

University of Houston — Teaching Assistant

- Geophysical Signal Processing Lab (Fall 2018 and Fall 2019): designed exercises on seismic, electromagnetic, and gravity data; taught MATLAB and Python data acquisition and processing.
- Global Seismology (Spring 2019 and Spring 2020): supported computational problem solving and visualization in Mathematica and graded examinations.
- Physical Geology (September 2015–May 2018): teaching-assistant and field-trip support, including Central Texas, Galveston, and campus geology activities.

Professional service

Journal reviewer: Geophysical Journal International; Artificial Intelligence in Geosciences; Earthquake Science. Co-organizer, SPECfem Users Workshop, 5–7 October 2022.