# Haipeng Li

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## Research Areas

Quantitative subsurface monitoring is limited by sparse observations, non-unique inversions, and physically coupled target systems. My research combines distributed acoustic sensing (DAS) for dense spatial-temporal coverage, full-waveform inversion for high-resolution multi-parameter imaging, and physics- and process-based constraints to reduce non-uniqueness—enabling quantitative monitoring of groundwater dynamics, geological carbon storage, and subsurface fluid injection.

## Education

**Stanford University** 2022–Fall 2027 (expected)
Ph.D. in Geophysics (GPA: 4.2/4.3).
Advised by Biondo Biondi and secondary advisor Greg Beroza.
Dissertation: *Quantitative Seismic Full-Waveform Monitoring of Subsurface Processes*.

**University of Science and Technology of China** 2019–2022
M.S. in Geophysics (GPA: 3.95/4.3). Advisor: Junlun Li.
Thesis: *Active and Passive Seismic Full-Waveform Imaging and Inversion* (Outstanding Thesis Award).

**China University of Petroleum (East China)** 2015–2019
B.S. in Geophysics (GPA: 3.92/4.0). Thesis: *Finite Element Simulation of Anisotropic Elastic Wavefield Propagation*.

## Research Experience

**Stanford Earth Imaging Project, Stanford University** 2022–present
Doctoral researcher.

- **Fiber-optic Sensing (Observations):** Demonstrated vehicular traffic, bridge vibrations, and ocean breakers as persistent seismic sources for continuous monitoring of urban aquifers, intertidal zones, and watershed responses to extreme rainfall.
- **Full-waveform Inversion (Modeling):** Devised time-lapse full-waveform inversion of fiber-optic seismograms to resolve subsurface elastic parameter changes and decouple saturation and pore-pressure effects during geological carbon storage.
- **Physical-process Constraints (Priors):** Integrated fluid-flow dynamics into waveform inversion to promote physically plausible solutions; now extending this to track hydraulic fracture opening in geothermal reservoirs with low-frequency DAS.
- **Generative Bayesian Inference (Posterior):** Proposed Bayesian sampling in the latent space of generative models for ill-posed waveform inversion, yielding subsurface states with quantified uncertainty for interpretation and decision-making.

**Shell USA, Inc. (Houston, Texas)** Summer 2024
Geophysics intern. Developed diffusion-based generative models conditioned on sparse well logs, geological context, and text prompts; applied them to field data to generate diverse subsurface realizations.

## Journal Publications

**First- or Corresponding-Author Articles** (* Corresponding author)

1. **Li, H.**, Wang, N., Durlofsky, L. J., & Biondi, B. L. (2026). Bayesian full-waveform monitoring of $CO_2$ storage with fluid-flow priors via generative modeling. *Journal of Geophysical Research: Machine Learning and Computation*, 3, e2025JH001190.
2. **Li, H.***, Liu, J., Mao, S., Yuan, S., Clapp, R. G., & Biondi, B. L. (2025). Fiber-optic seismic full waveform monitoring of groundwater dynamics. *Geophysical Research Letters*, 52, e2025GL117610.
3. **Li, H.***, Liu, J., & Biondi, B. L. (2025). Near-surface imaging and monitoring enabled by urban distributed acoustic sensing seismic arrays. *The Leading Edge*, 44(8), 588–597.
4. Liu, F., **Li, H.***, Zou, G., & Li, J. (2025). Automatic differentiation-based full waveform inversion with flexible workflows. *Journal of Geophysical Research: Machine Learning and Computation*, 2, e2024JH000542.
5. **Li, H.**, Li, J., Luo, S., Bem, T. S., Yao, H., & Huang, X. (2023). Continent-continent collision between the South and North China plates revealed by seismic refraction and reflection at the southern segment of the Tanlu Fault Zone. *Journal of Geophysical Research: Solid Earth*, 128, e2022JB025748.
6. **Li, H.**, & Li, J. (2022). Elastic transmitted wave reverse time migration for imaging Earth's interior discontinuities: A numerical study. *Bulletin of the Seismological Society of America*, 112(5), 2231–2256.
7. **Li, H.**, Chen, J., Zhao, Z., & Li, J. (2021). A multi-axial perfectly matched layer for finite-element time-domain simulation of anisotropic elastic wave propagation. *Journal of Seismic Exploration*, 30(2), 173–200.

8. **Li, H.**, Li, J., Gu, N., Gao, J., & Zhang, H. (2020). Ambient noise surface wave reverse time migration for fault imaging. *Journal of Geophysical Research: Solid Earth*, 125, e2020JB020381.

**Coauthored Articles**

9. Liu, J., Aggarwal, J., Hwang, D., Lee, J., Wu, Y., Yin, F., **Li, H.**, Santi, P., Sohn, H., Biondi, B. L., Ratti, C., & Noh, H. Y. (2026). Bridge health monitoring using existing telecommunication fiber-optic networks. *Nature Communications*, 17, 9966.
10. Liu, J., **Li, H.**, Li, J., Hwang, D., Aggarwal, J., Biondi, B. L., & Noh, H. Y. (2025). Urban monitoring using preexisting telecommunication fiber-optic networks for distributed acoustic sensing: A review. *IEEE Sensors Journal*, 25(21), 39353–39370.
11. Liu, J., **Li, H.**, Yuan, S., Noh, H. Y., & Biondi, B. L. (2025). Characterizing vehicle-induced distributed acoustic sensing signals for accurate urban near-surface imaging. *Seismological Research Letters*, 96(5), 2867–2880.
12. Liu, J., **Li, H.**, Noh, H. Y., Santi, P., Biondi, B. L., & Ratti, C. (2025). Urban sensing using existing fiber-optic networks. *Nature Communications*, 16, 3091.
13. Ni, H., Li, J., Yao, H., Huang, X., Li, L., Zhou, D., Wang, X., Yu, S., Lu, Y., Yu, J., Zheng, H., Zhou, G., Zou, H., Yang, W., Zhang, M., Chen, G., Lin, Y., Peng, G., Li, Z., & **Li, H.** (2025). Preliminary study of the tectonic structure and seismogenic environment of the M4.7 Feidong earthquake sequence on September 18, 2024 in Hefei. *Earthquake Science*, 38(3), 234–252.
14. Wang, J., Li, H., Zhang, Y., **Li, H.**, Li, Y., Ma, Z., & Xiang, Y. (2024). Shallow crustal structure of the northern Longmen Shan fault zone revealed by a dense seismic array with ambient noise analysis. *Journal of Asian Earth Sciences*, 276, 106338.
15. Zheng, X., Li, J., Xiong, Q., Xie, J., **Li, H.**, Tan, J., Liu, Z., & Duan, T. (2024). Application of active-source full waveform inversion in multi-resource exploration in Juyanhai depression of Inner Mongolia. *Chinese Journal of Geophysics*, 67(8), 3120–3135.
16. Qu, Y., Sun, J., Li, Z., Huang, J., **Li, H.**, & Sun, W. (2018). Forward modeling of ocean-bottom cable data and wave-mode separation in fluid–solid elastic media with irregular seabed. *Applied Geophysics*, 15(3–4), 432–447.

## Manuscripts Under Review

1. **Li, H.***, Clapp, R. G., Yin, F., Ajo-Franklin, J. B., & Biondi, B. L. Time-lapse full-waveform inversion using prior-guided geometric constraints. Under revision for *Geophysics*.
2. **Li, H.***, Liu, J., Hwang, D., Noh, H. Y., & Biondi, B. L. (2026). Bridge Vibrations as Persistent Seismic Sources for Time-lapse Imaging of River Corridors with Distributed Acoustic Sensing. Under review. Preprint: arXiv:2610.09289.

## Invited Talks

- Toward quantitative monitoring of subsurface processes with distributed acoustic sensing. AGU Fall Meeting, San Francisco, December 2026.
- NSF National Geophysical Facility Community Science Conference, Virtual, May 2026.
- Center for Wave Phenomena Seminar, Colorado School of Mines, Golden, October 2025.
- NEC Laboratories America, Princeton, July 2025.
- Seismological Society of America Annual Meeting, Baltimore, April 2025.
- Department of Earth, Environmental and Planetary Sciences, Rice University, Houston, August 2024.

## Fellowships, Scholarships, and Honors

- Honorable Mention for Best Paper in *The Leading Edge*, SEG, 2026.
- Top 10 Outstanding Reviewers, *Annals of Geophysics*, 2026.
- Jon Claerbout Fellowship, Stanford University, 2025.
- Geophysics Student Travel Grant, Stanford University, 2025.
- Shirley A. and Stanley H. Ward Scholarship, SEG Foundation, 2022.
- Chevron Scholarship, SEG Foundation, 2021.
- Michael C. Forrest Scholarship, SEG Foundation, 2020.
- National Scholarship, China, 2016, 2017, 2018, and 2021.

## Teaching Experience

**Fiber Sensing for a Sustainable Planet (GEOPHYS 150/250)** Spring 2026
Teaching assistant, Stanford University; instructor: Biondo Biondi. Co-developed course materials and Python labs for its first offering, covering DAS wavefield modeling, signal processing, seismic interferometry, and beamforming with field data.

**3D Seismic Imaging (GEOPHYS 280)** Spring 2025
Teaching assistant, Stanford University; instructor: Biondo Biondi. Translated legacy Fortran lab code into Python and guided students through computational labs on wave-equation modeling, seismic imaging, and inversion, including work with field data.

## Professional Service

- Peer reviewer for *Communications Earth & Environment*, *Geophysical Research Letters*, *Journal of Geophysical Research: Solid Earth*, *Journal of Geophysical Research: Machine Learning and Computation*, *Seismological Research Letters*, *Seismica*, *The Seismic Record*, *Bulletin of the Seismological Society of America*, *Geophysics*, *Geophysical Journal International*, *Science China Earth Sciences*, *Annals of Geophysics*, and *Journal of Open Source Software*.
- Co-organizer, Engineering Geophysics Subcommittee, SEG Near-Surface Geophysics Technical Section, 2026–present.
- Session chair, SEG Smart CCUS Technical Program (2026); IMAGE special session on near-surface geophysics (2026).
- Student member, AGU, SSA, and SEG.

## Public Engagement and University Service

- Interview on DAS and groundwater–seismicity links in Mexico City, *El País* (Mexico edition, national daily), July 2026.
- Guest, SEG *Seismic Soundoff*: "The Low-Cost Seismic Revolution Already Buried in Your City," September 2025.
- Graduate peer mentor, Department of Geophysics, Stanford University, 2024 and 2026.
- Representative of the Geophysics Department on Stanford's Graduate Student Council (GSC), 2023–2024.

## Technical Expertise

**Programming:** Python, C/C++, Fortran, Julia, MATLAB, CUDA, MPI, PyTorch.
**Software:** Developed SWIT (Seismic Waveform Inference Toolbox), a high-performance differentiable framework for 2D and 3D acoustic, elastic, and viscoelastic full-waveform inversion and Bayesian uncertainty quantification.