Mingming Li

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Education

2015:	Ph.D. Geological Sciences, School of Earth and Space Exploration, Arizona State University; Advisor: Allen K. McNamara
2010:	M.S. Geophysics, Institute of Geology and Geophysics, Chinese Academy of Sciences; Advisor: Yumei He
2007:	B.S. Geophysics, Yunnan University

Employment

2024 -	Associate Professor, School of Earth and Space Exploration, Arizona State University
2017 - 2024	Assistant Professor, School of Earth and Space Exploration, Arizona State University
2015-2017:	Postdoctoral Research Associate, Department of Physics, University of Colorado, Boulder

Professional Network

Google Scholar	Publication and citation records	[link]
ORCID	Research digital identifier	[link]
Github	Open-source code repository	[link]
ResearchGate	Publication list with reprints	[link]

Membership

American Geophysical Union

Part 1. Research

Research Interests

Geologic events on Earth such as earthquakes, volcanoes, and changes of topography, are controlled by processes in the deep interior. I conduct geodynamic modeling experiments using computer simulations to investigate the interior processes of the Earth. My research sheds light on the fundamental mechanisms that control the processes of the inaccessible interiors of the Earth and their surface expressions.

I also use computer simulations to explore the interiors of other solar and extrasolar planets to understand their distinct patterns of evolution compared to Earth.

Peer-reviewed Publications

2026

47. Xu, E., J. Wolf, D.A. Frost, **M. Li**, and M.D. Long (2026). Lowermost mantle deformation beneath Australia linked to deep mantle upwellings and putative remnant slab material. *Geophys. J. Int.* 246(3), ggag282.
46. Wolf, J., **M. Li**, and B. Romanowicz (2026). Mantle deformation records fossil convergent upwelling at Perm Anomaly. *Nat. Commun.* 17(1), 4746.

2025

45. Kar, P., and **M. Li** (2025). Long-Term Survival of Large Low Velocity Provinces (LLVPs) Due to Internal Layering. *Physics of the Earth and Planetary Interiors*, 368, 107452.
44. Li, J., D. Tian, **M. Li**, R. Chu (2025). Small-Scale Heterogeneities in the Lowermost Mantle Near the Perm Anomaly. *J. Geophys. Res. Solid Earth*, 130(8), e2025JB031160.
43. Li, J., D. Tian, **M. Li**, D. Sun, Z. Mao, V.V. Dobrosavljevic (2025). Ultralow Velocity Zones at the Core-Mantle Boundary Near the Caroline Hotspot, *J. Geophys. Res. Solid Earth, 130*(7), e2024JB030763.

2024

42. Su, Y., S. Ni, B. Zhang, Y. Chen, W. Wu, **M. Li**, H. Sun, M. Hou, X. Cui, and D. Sun (2024), Detections of ultralow velocity zones in high-velocity lowermost mantle linked to subducted slabs, *Nature Geosci.*, *17*(4), 332-339
41. Agboola, K. J., S. E. Hansen, E. J. Garnero, S. Rost, **M. Li**, and S.-H. Shim (2024), Ultra-Low Velocity Zones Beneath the Southern Hemisphere Imaged With Double-Array Stacking of PcP Waveforms, *J. Geophys. Res.*, *129*(4), e2023JB028170
40. Festin, M. M., M. S. Thorne, and **M. Li** (2024), Evidence for Ultra-Low Velocity Zone Genesis in Downwelling Subducted Slabs at the Core–Mantle Boundary, *The Seismic Record*, *4*(2), 111-120

39. Wolf, J., **M. Li**, A. A. Haws, and M. D. Long (2024), Strong seismic anisotropy due to upwelling flow at the root of the Yellowstone mantle plume, *Geology*, *52*(5), 379-382

38. Wolf, J., **M. Li**, M. D. Long, and E. Garnero (2024), Advances in Mapping Lowermost Mantle Convective Flow With Seismic Anisotropy Observations, *Reviews of Geophysics*, *62*(2), e2023RG000833

37. Thorne, M. S., S. Pachhai, **M. Li**, J. Ward, and S. Rost (2024), Investigating Ultra-Low Velocity Zones as Sources of PKP Scattering Beneath North America and the Western Pacific Ocean: Potential Links to Subducted Oceanic Crust, *AGU Advances*, 5(4), e2024AV001265.

36. Wolf, J., **M. Li**, and M. D. Long (2024), Low-velocity heterogeneities redistributed by subducted material in the deepest mantle beneath North America, *Earth Planet. Sci. Lett.*, 642, 118867.

35. **Li, M.**, J. Wolf, E. Garnero, and M. D. Long (2024), Flow and Deformation in Earth's Deepest Mantle: Insights From Geodynamic Modeling and Comparisons With Seismic Observations, *Journal of Geophysical Research – Solid Earth*, 129(12), e2024JB029058.

2023

34. Wolf, J., M. D. Long, M. Li, and E. Garnero (2023), Global Compilation of Deep Mantle Anisotropy Observations and Possible Correlation With Low Velocity Provinces, *Geochem. Geophys. Geosyst.*, *24*(10), e2023GC011070.

33. **Q. Yuan***, **M. Li**, B. Ko, S. Desch, H. Deng, E. Garnero, S.J. Gabriel, J.A. Kegerreis, Y. Miyazaki, and V. Eke (2023). Moon-forming impactor as a source of Earth's basal mantle anomalies. *Nature 623(7985): 95-99.*

32. **M. Li** (2023). Variable distribution of subducted oceanic crust beneath subduction regions of the lowermost mantle. *Physics of the Earth and Planetary Interiors,* 341, 107063.

31. **M. Li**, S. Puetz, K. Condie, and P. Olson (2023). Mantle plume heat flux and surface motion periodicities and their implications for the growth of continental crust. *Earth and Planetary Science Letters,* 611, 118148.

30. S.E. Hansen, E.J. Garnero, **M. Li**, S.-H. Shim, and S. Rost (2023). Globally distributed subducted materials along the Earth's core-mantle boundary: Implications for ultralow velocity zones. *Science Advances*, 9, eadd4838.

29. **M. Li** (2023). The influence of uncertain mantle density and viscosity structures on the calculations of deep mantle flow and lateral motion of plumes. *Geophysical Journal International*, 233, 1916-1937.

2022

28. **Q. Yuan***, and **M. Li** (2022b). Vastly Different Heights of LLVPs Caused by Different Strengths of Historical Slab Push. *Geophysical Research Letters*, 49, e2022GL099564.

27. B. Ko, S. Chariton, V. Prakapenka, B. Chen, E.J. Garnero, **M. Li**, and S.-H. Shim (2022). Water-Induced Diamond Formation at Earth's Core-Mantle Boundary. *Geophysical Research Letters*, 49, e2022GL098271.
26. **Q. Yuan***, and **M. Li** (2022a). Instability of the African large low-shear-wave-velocity province due to its low intrinsic density. *Nature Geoscience*, 15, 334-339.
25. **M. Li**, and A.K. McNamara (2022). Evolving morphology of crustal accumulations in Earth's lowermost mantle. *Earth and Planetary Science Letters*, 577, 117265.
24. S. Pachhai, **M. Li**, M.S. Thorne, J. Dettmer, and H. Tkalčić (2022). Internal structure of ultralow-velocity zones consistent with origin from a basal magma ocean. *Nature Geoscience*, 15, 79-84.

2021

23. B.C. Chandler, L.-W. Chen, **M. Li**, B. Romanowicz, and H.-R. Wenk (2021). Seismic anisotropy, dominant slip systems and phase transitions in the lowermost mantle. *Geophysical Journal International*, 227, 1665-1681.
22. W. Wang, J. Liu, F. Zhu, **M. Li**, S.M. Dorfman, J. Li, and Z. Wu (2021). Formation of large low shear velocity provinces through the decomposition of oxidized mantle. *Nature Communications*, 12, 1911.
21. **Y. Wang†**, and **M. Li§** (2021). The interaction between mantle plumes and lithosphere and its surface expressions: 3-D numerical modelling. *Geophysical Journal International*, 225, 906-925.
20. **M. Li** (2021). The Cycling of Subducted Oceanic Crust in the Earth's Deep Mantle, in *Mantle Convection and Surface Expressions*, Editor: H. Marquardt, M. Ballmer, S. Cottaar, and J. Konter, Geophysical Monograph Series. Page: 303-328.

2020

19. **Y. Wang†**, and **M. Li** (2020). Constraining Mantle Viscosity Structure from a Statistical Analysis of Slab Stagnation Events. *Geochemistry, Geophysics, Geosystems*, 21, e2020GC009286.
18. **M. Li** (2020). The Formation of Hot Thermal Anomalies in Cold Subduction-Influenced Regions of Earth's Lowermost Mantle. *Journal of Geophysical Research*, 125, e2019JB019312.

2019

17. **M. Li**, and S. Zhong (2019). Lateral Motion of Mantle Plumes in 3-D Geodynamic Models. *Geophysical Research Letters*, 46, 4685-4693.
16. Y. Wang, G.L. Pavlis, and **M. Li** (2019). Heterogeneous distribution of water in the mantle transition zone inferred from wavefield imaging. *Earth and Planetary Science Letters*, 505, 42-50.

2018

15. **M. Li**, S.J. Zhong, and P. Olson (2018). Linking lowermost mantle structure, core-mantle boundary heat flux and mantle plume formation. *Physics of The Earth and Planetary Interiors*, 277, 10-29.
14. **M. Li**, and A.K. McNamara (2018). The influence of deep mantle compositional heterogeneity on Earth's thermal evolution. *Earth and Planetary Science Letters*, 500, 86-96.
13. B. Chandler, K. Yuan, M. Li, S. Cottaar, B. Romanowicz, C. N. Tomé, and H. R. Wenk (2018). "A refined approach to model anisotropy in the lowermost mantle." In *IOP Conference Series: Materials Science and Engineering*, vol. 375, no. 1, p. 012002. IOP Publishing.

2017

12. **M. Li**, and S.J. Zhong (2017). The source location of mantle plumes from 3D spherical models of mantle convection. *Earth and Planetary Science Letters*, 478, 47-57.
11. **M. Li**, A.K. McNamara, E.J. Garnero, and S. Yu (2017). Compositionally-distinct ultra-low velocity zones on Earth's core-mantle boundary. *Nature Communications*, 8, 177.
10. C. Zhao, E.J. Garnero, **M. Li**, A. McNamara, and S. Yu (2017). Intermittent and lateral varying ULVZ structure at the northeastern margin of the Pacific LLSVP. *Journal of Geophysical Research: Solid Earth*, 122, 1198-1220.
9. D.A. Frost, S. Rost, E.J. Garnero, and **M. Li** (2017). Seismic evidence for Earth's crusty deep mantle. *Earth and Planetary Science Letters*, 470, 54-63.

Before 2017

8. **M. Li**, B. Black, S. Zhong, M. Manga, M.L. Rudolph, and P. Olson (2016). Quantifying melt production and degassing rate at mid-ocean ridges from global mantle convection models with plate motion history. *Geochemistry, Geophysics, Geosystems*, 17, 2884-2904.
7. Z. Zhang, S.M. Dorfman, J. Labidi, S. Zhang, **M. Li**, M. Manga, L. Stixrude, W.F. McDonough, and Q. Williams (2016). Primordial metallic melt in the deep mantle. *Geophysical Research Letters*, 43, 3693-3699.
6. T. Gu, **M. Li**, C. McCammon, and K.K.M. Lee (2016). Redox-induced lower mantle density contrast and effect on mantle structure and primitive oxygen. *Nature Geoscience*, 9, 723-727.
5. C.D. Williams, **M. Li**, A.K. McNamara, E.J. B. Ko, and M.C. van Soest (2015). Episodic entrainment of deep primordial mantle material into ocean island basalts. *Nature Communications*, 6, 8937.
4. **M. Li**, A.K. McNamara, and E.J. Garnero (2014). Chemical complexity of hotspots caused by cycling oceanic crust through mantle reservoirs. *Nature Geoscience*, 7, 366-370.

3. S. Cottaar, **M. Li**, A.K. McNamara, B. Romanowicz, and H.-R. Wenk (2014). Synthetic seismic anisotropy models within a slab impinging on the core–mantle boundary. *Geophysical Journal International*, 199, 164-177.
2. **M. Li**, and A.K. McNamara (2013). The difficulty for subducted oceanic crust to accumulate at the Earth's core-mantle boundary. *Journal of Geophysical Research – Solid Earth*, 118, 1807-1816.
1. **M. Li**, and Y.M. He (2011). Lithospheric structure beneath northeastern boundary region of the North China Craton from Rayleigh wave dispersion inversion. *Acta Seismologica Sinica*, 33, 143-155.

Part 2. Teaching and Mentoring

Teaching

S = Spring, F = Fall

2025 S	GLG101 Introduction to Geology
2024 F	Sabbatical
2024 S	SES494/598 Python for graduate research
2023 F	GLG418/598 Geophysics
2023 S	no teaching due to teaching relief
2022 F	GLG418/598 Geophysics
2022 S	SES494/598 Exploring data with Python
2021 F	GLG418/598 Geophysics
2021 S	GLG490/598 Numerical methods
2020 F	SES494/598 Python for graduate research
2020 S	GLG419/598 Geodynamics
2019 F	GLG101 Introduction to Geology
2019 S	SES494/598 Exploring data with Python
2018 F	GLG418/598 Geophysics
2018 S	GLG494/591 Dynamic topography and geoid
2017 F	SES 494/591 The Dynamic Planets, 2017 fall

Mentoring

Ph.D. Students

2024 -	Guangpu Yi
2022 -	Prachi Kar
2018 -	Camerian Millsaps
2018-2022	Qian Yuan

M.S. Students

2018-2022	Linnea Ravacz

Postdoc

2018-2020	Yongming Wang

Part 3. Service

Service at ASU

2023 – 2024 Postdoc Committee

2022 – 2023 SESE Inclusive Community Committee

2019-2022 SESE Graduate Student Committee

2019 SESE Nininger Student Travel Award Committee

Professional Service Outside of ASU

AGU = American Geophysical Union
NSF = National Science Foundation
NASA = National Aeronautics and Space Administration

2017 – Associate Editor for journal Geophysical Research Letter (or GRL)

2022 Session Chair and Convener for AGU Fall Meeting.

2021 Session Chair and Primary Convener for AGU Fall Meeting.

2020 Session Chair and Primary Convener for AGU Fall Meeting.

2019 Outstanding Student Presentation Award Judge for AGU Fall Meeting

2019 NSF Geophysics program review panel

2018 NASA Solar System Workings program review panel

2017 Session Chair and Primary Convener for AGU Fall Meeting.

2015 Session Chair and Primary Convener for AGU Fall Meeting.

Outreach

I make animated cartoons about basic concepts of geophysics, geodynamics, and numerical modeling, and upload them on my personal website [link] and YouTube Channel [link], and share with students in classes.

I provide hand-on software about mantle convection to students in geodynamics class for them to better understand the mechanism of mantle convection.

I am developing a new mantle convection code, which is uploaded on Github [link] for free access.