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Xiyuan Bao

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Department of Earth and Planetary Sciences, Harvard University

Education

Ph.D. in Geophysics, University of California, Los Angeles 2018-Mar 2024
M.S. in Geophysics, University of California, Los Angeles 2018-2020
B.S. of Geophysics with Honors , University of Science and Technology of China 2014-2018
Minor in Computer Science , University of Science and Technology of China 2014-2018

Experience

Reginald A. Daly Postdoctoral fellow, Harvard University Oct 2024-
Postdoctoral Scholar, University of California, Los Angeles Mar 2024-Sep 2024
Graduate Research Assistant, University of California, Los Angeles Sep 2018-Mar 2024
Hotspots from Top to Bottom (Advisor: Carolina Lithgow-Bertelloni)

Undergraduate Research Assistant, University of Science and Technology of China Sep-May 2018
Benchmark on CitcomToEllipsis: Spontaneous subduction towards free surface (Advisor: Wei Leng)

Visiting Undergraduate, University of Illinois, Urbana-Champaign Jun-Aug 2017
Constraining the Nature of the LLSVPs Using Geoid and Dynamic Topography (Advisor: Lijun Liu)

Honors & Awards

- Gordon and Betty Moore Foundation Fellowship 2025
- Reginald A. Daly Postdoctoral Research Fellowship, Harvard University 2024
- Study of the Earth's Deep Interior Section Award for Graduate Research, AGU 2023
- Computers and Geosciences Research Scholarship, IAMG 2022
- Jiuzhang Zhao Talent Program in Earth and Space Sciences, USTC 2015-2018
- Award from National Undergraduate Innovation Training Program, USTC 2017-2018
- Earth Science Climbing Scholarship, USTC 2015, 2017
- Silver Scholarship for Outstanding Students, USTC 2016
- First Prize of Physics Innovation Research Experiment Thesis Competition, USTC 2016

Publications

[6] **Bao, X.** & Lithgow-Bertelloni, C. R. Self-correction of the optical distortion effect of thermal plumes in particle image velocimetry. *Physics of Fluids.* https://doi.org/10.1063/5.0233759 (2024).

[5] **Bao, X.** Giant impact and Earth's mysterious blobs: An interdisciplinary revelation. *Science Bulletin* **69,** 293–294 (2024).

[4] **Bao, X.,** Mittal, T. & Lithgow-Bertelloni, C. R. Determining Mid-Ocean Ridge Geography from Upper Mantle Temperature. *Earth and Planetary Science Letters* **641,** 118823 (2024).

[3] Zhang, X., Brown, E. L., Zhang, J., Lin, J., **Bao, X.** & Sager, W. W. Magmatism of Shatsky Rise controlled by plume-ridge interactions. ***Nature Geoscience***. https://www.nature.com/articles/s41561-023-01286-0 (2023).

[2] Li, S., Li, J., Ferrand, T. P., Zhou, T., Lv, M., Xi, Z., Maguire, R., Han, G., Li, J., **Bao, X.,** *et al.* Deep geophysical anomalies beneath the Changbaishan Volcano. *Journal of Geophysical Research: Solid Earth,* e2022JB025671. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2022JB025671 (2023).

[1] **Bao, X.,** Lithgow-Bertelloni, C. R., Jackson, M. G. & Romanowicz, B. On the relative temperatures of Earth's volcanic hotspots and mid-ocean ridges. ***Science* 375,** 57–61. ISSN: 0036-8075. https://www.science.org/doi/10.1126/science.abj8944 (2022).

Manuscripts submitted

[5] Lucas, E., Richards, F., Cederberg, G., **Bao, X.,** Hoggard, M. J., Tsuji, S. R. J., Latychev, K., Tsuji, L. J. S. & Mitrovica, J. *Emergence of Antarctic mineral resources in a warming world.* Revision Under review in ***Nature Climate Change***.

[4] Cai, R., **Bao, X.,** Foley, S. F., Giuliani, A., Jiang, S., Pearson, D. G. & Liu, J. *Evidence for a highly fusible fundamental constituent in the convective mantle.* submitted.

[3] **Bao, X.,** Wamba, M. D. & Stracke, A. *A deep-mantle geochemical zoning map beneath East Africa and Indian Ocean.* Under review in ***Science***.

[2] **Bao, X.** & Lithgow-Bertelloni, C. R. *End-to-End workflow for 4-dimensional flow measurements and analysis in viscous Rayleigh-Bénard Convection* submitted.

[1] **Bao, X.** & Lithgow-Bertelloni, C. R. *Interaction and evolutionary pathways of laminar thermal plumes revealed by 4-dimensional velocity measurements and analysis: Application to mantle plumes* submitted.

Manuscripts in prep

[4] Coulson, S., Lloyd, A., **Bao, X.,** Mitrovica, J. X., Dangendorf, S., Pan, L., Valencic, N., Tamisea, M. E., Al-Attar, D. & Heathcotte, D. *Inverting Sea Surface Height Data for Greenland Ice Mass Changes (1993-2019): A Proof of Concept*

[3] **Bao, X.,** Coulson, S., Valencic, N., Mitrovica, J., Dangendorf, S., Mousavi, M. & Lloyd, A. *Inverting Sea Level Fingerprints for Ice Mass Changes Using Neural Operators: How Much Can We Recover and How Unique Is It?*

[2] **Bao, X.,** Cao, Z., Gourley, K. C., Gutierrez, S., Liang, Y., Zhou, D., Buffett, B. A., Mittal, T., Li, J., Pierrehumbert, R., Schaefer, L., Orman, J. V. & Foley, B. J. *Coupled Evolution of Earth's Hydrogen Distribution and Thermal History.*

[1] Wang, W., Zhang, X., Lin, J., Cheng, Z., **Bao, X.,** Zhang, F., Kelley, K. A., Chen, L. & Chu, F. *Ultra-depleted mantle supporting the Marion Rise: implications for ocean rise dynamics*

Oral Presentations

[17] *Inverting Sea Level Fingerprints for Ice Mass Changes Using Neural Operators: How Much Can We Recover and How Unique Is It?* AGU Fall Meeting 2025 (New Orleans, LA, US, Dec. 2025).

[16] ***Invited:*** *Deep Provenance of East African and Indian Ocean Hotspots through Tomography, Graph Theory, and Geochemical Cross-validation* Brownbag Seminar (Princeton University, Princeton, NJ, US, Nov. 2025).

[15] ***Invited:*** *Deep Provenance of East African and Indian Ocean Hotspots through Tomography, Graph Theory, and Geochemical Cross-validation* Geophysics Hour (Arizona State University, Tempe, AZ, US, Nov. 2025).

[14] ***Invited:*** *Plumes over LLSVPs: Supercharging multi-scale flow resolution with hybrid experimental-adjoint digital twins* Geophysics Seminar (Brown University, RI, US).

[13] *Plumes over LLSVPs: Supercharging multi-scale flow resolution with hybrid experimental-adjoint digital twins* BiSEPPS Seminar (Harvard University, MA, US, Nov. 2024).

[12] ***Invited:*** *A Song of Ice and Fire: Operator Learning for Viscous Flow from Mantle Convection to Ice Dynamics* Daly Special Seminar (Harvard University, MA, US, Feb. 2024).

[11] ***Invited:*** *Hotspots from Top to Bottom* Geophysics Seminar (University of Science and Technology of China, Anhui, China, Jan. 2024).

[10] ***Invited:*** *Illuminating Mantle Convection: Unraveling Plume Dynamics over LLSVPs in the Laboratory* AGU Fall Meeting 2023 (San Francisco, CA, US, Dec. 2023).

[9] ***Invited:*** *Hotspots from Top to Bottom* Earth Sciences Seminar (Unversity of Southern California, CA, US, Oct. 2023).

[8] *The plume zoo of thermal LLSVPs* AGU Fall Meeting 2022 (Chicago, IL, US, Dec. 2022), V26A–02.

[7] *Coupled Evolution of Earth's Hydrogen Distribution and Thermal History* AGU Fall Meeting 2022 (Chicago, IL, US, Dec. 2022), MR33A–06.

[6] ***Invited:*** *Hotspots from Top to Bottom* Seismo Lab Seminar (California Institue of Technology, CA, US, Nov. 2022).

[5] ***Invited:*** *Are hotspots hotter than ridges?* IGCP 648 Virtual Seminar Series (Curtin University, Australia, Nov. 2022), Series 5, Seminar 5. https://www.youtube.com/watch?v=30B21c7NGIY.

[4] *Experimental Investigation of Purely Thermal LLSVPs* UCLA EPSS Seismology and Tectonics Seminar (UCLA, CA, US, May 2022).

[3] *Accurate Prediction of Ocean Basins Using Upper Mantle Potential Temperatures* AGU Fall Meeting 2021 (New Orleans, LA, US, Dec. 2021), DI34A–05.

[2] *Accurate Prediction of Ocean Basins Using Upper Mantle Potential Temperatures* UCLA EPSS Geology/Geophysics Seminar (UCLA, CA, US, Oct. 2021).

[1] *Correlation of geochemical signals with MORB and OIB temperatures* UCLA EPSS Geocheminar (UCLA, CA, US, Oct. 2019).

Poster Presentations

[13] **Bao, X.,** Wamba, M. D. & Stracke, A. in. AGU Fall Meeting 2025 (New Orleans, LA, US, Dec. 2025).

[12] **Bao, X.,** Coulson, S., Valencic, N., Mitrovica, J., Dangendorf, S., Mousavi, M. & Lloyd, A. in. 2025 Gordon Research Seminar: Interior of the Earth (June 2025).

[11] **Bao, X.** & Lithgow-Bertelloni, C. R. in. AGU Fall Meeting 2024 (Washington DC, US, Dec. 2024).

[10] **Bao, X.** & Lithgow-Bertelloni, C. R. in. 2024 Ada Lovelace Workshop on Modelling Mantle and Lithosphere Dynamics (University of California, Berkeley, CA, US, Sept. 2024).

[9] **Bao, X.** in. AGU Fall Meeting 2023 (San Francisco, CA, US, Dec. 2023).

[8] **Bao, X.** & Lithgow-Bertelloni, C. R. in. 2023 Gordon Research Seminar: Interior of the Earth (Mount Holyoke College, MA, US, June 2023).

[7] **Bao, X.** & Lithgow-Bertelloni, C. R. in. Seismo Lab Centenial (California Institue of Technology, US, Nov. 2022).

[6] **Bao, X.** & Lithgow-Bertelloni, C. R. in. 2022 Ada Lovelace Workshop on Numerical Modelling of Mantle and Lithosphere Dynamics (Hévíz, Hungary, Aug. 2022).

[5] **Bao, X.** & Lithgow-Bertelloni, C. R. in. CIDER2022 (University of California, Berkeley, CA, US, July 2022).

[4] **Bao, X.,** Lithgow-Bertelloni, C. R. & Jackson, M. G. in. AGU Fall Meeting 2020 (San Francisco, CA, US, Dec. 2020), DI007–0006.

[3] Wang, Y., Liu, L. & **Bao, X.** in. AGU Fall Meeting 2020 (San Francisco, CA, US, Dec. 2020), DI005–0005.

[2] **Bao, X.,** Lithgow-Bertelloni, C. R. & Jackson, M. G. in. AGU Fall Meeting 2019 (San Francisco, CA, US, Dec. 2019), DI41D–0028.

[1] **Bao, X.** & Lithgow-Bertelloni, C. R. in. 2019 Gordon Research Seminar: Interior of the Earth (Mount Holyoke College, MA, US, June 2019).

Professional Service

- **Guest Editor**, *PNAS Nexus*, 2025 Call for Papers in *Machine Learning and Geosciences*
- **Primary Session Convener and Chair**, *Advances in Machine Learning for Solid Earth Geoscience*, AGU Fall Meeting 2025
- **Primary Session Convener and Chair**, *Advances in Deep Earth–Surface Interactions*, AGU Fall Meeting 2024
- **Discussion Leader**, *The Structure and Composition of the Lower Mantle*, Gordon Research Seminar 2023
- **Primary Session Convener and Chair**, *Advances in Mantle Convection and Planetary Evolution*, AGU Fall Meeting 2022
- **Reviewer**, *Nature Geoscience*; *Journal of Geophysical Research: Solid Earth*; *Geophysical Journal International*; *Planetary Science Journal*; *Physics of Fluids*; *Earth and Planetary Physics*; *Frontiers in Earth Science*
- **Reviewer**, National Science Foundation, Geophysics Program

Other Service

- Committee Member of UCLA EPSS Family Mentorship Program (EFMP)

Outreach

- *Rheology, Plate Tectonics with Food* Saturday Science Academy, UCLA/Charles R. Drew University Mar 2023
- *Why Hawaii is a volcano? How do Alaskan volcanos differ?* EYU, UCLA Nov 2022
- **Media Interview** about our *cold hotspots, e.g. ScienceNews, New Scientist*[1,2] *Popular Science, and Deutschlandfunk* Jan 2022
- **Invited Outreach Article** *Rocks beneath volcanic hotspots can be surprisingly cool* Jan 2022
- *The sweet smell of Earth's mantle: Why is Hawaii a volcano?* EYU, UCLA Nov 2020, 2021
- Lab visit from Tokyo Tech. UCLA Feb 2020
- *Why is Hawaii a volcano?* Explore Your Universe, UCLA Nov 2019

Teaching Experience

- Blue Planet: Introduction to Oceanography, Teaching Assistant, UCLA Spring 2020
- Earthquakes, Teaching Assistant, UCLA Spring 2019, Fall 2021

Mentoring Experience

- Jade Wight, undergrad, *Modeling Mantle Plumes and Their Effect on Dynamic Topography*, won *2020 Deane Oberste-Lehn Scholarship*, UCLA Oct 2019 - Jun 2021
- Wan Ki (Arthur) Lo, undergrad, *Dynamics of Adjacent Mantle Plumes through Physical and Computer Simulations*, won *2021 Harold and Mayla Sullwold Scholarship*, UCLA Jan 2020 - Jun 2022
- Kavya Agarwal, undergrad, *Compositional and thermodynamical effect on mantle plumes; Critical plume merge distance with shadowgraph*, IIT Sep 2021 - Aug 2022