

Claire Richardson

Curriculum Vitae

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Visiting Scholar

School of Earth and Space Exploration (SESE)
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EDUCATION

2025 **Ph.D., Geological Sciences (Computational Geophysics)**

Arizona State University; Tempe, AZ; USA

Dissertation: *New methods for improving global and regional seismic models of Earth's mantle*

Advisor: Prof. Ed Garnero

2018 **B.S., Geology (summa cum laude)**

University of Nebraska-Lincoln; Lincoln, NE; USA

Minors: Math & Physics

Honors thesis: *Integrated geophysical analysis of the New Caledonia Trough with implications for the geologic history and continental status of Zealandia*

RESEARCH & TECHNICAL INTERESTS

Imaging Earth's Mantle

In my capacity as a theoretical and computational seismologist, my research focuses on the 3D multi-scale structure and dynamics of the mantle. In particular, I am interested in the core-mantle boundary region: what is the physical and chemical nature of the diverse structures that we see there in seismic images? What is their relationship with mantle flow? Are they long-lived, primordial features, or do they have more dynamic life cycles? What is their relationship with the core, and how do they affect features and phenomena we observe at the surface?

Scientific Software Development & Data

To answer geophysical questions about the mantle and the core-mantle boundary, I employ computational modeling methods and tools. I have developed complex statistical modeling software to model global velocity structure in planetary interiors, which I have applied to Earth's mantle.

As creator and sole developer of this software, I brought the project from conception (i.e., research plan and requirements) through the entire development lifecycle to deployment. This included rigorous testing, troubleshooting, debugging, and documentation to ensure a robust product. I designed the software for parallelized HPC deployment, collaborating directly with domain scientists, HPC staff, and system administrators. Given the data-driven nature of the model, I also designed and implemented data pipelines to ingest, process, transform, and analyze large (up to 10TB) datasets, including I/O and storage management. In short, I discovered a love for software and data engineering while pursuing the research challenges of seismically imaging a region of the Earth 3000 km below our feet. I eagerly pursue opportunities to apply these skills to exciting new research and discovery.

Other scientific interests

Beyond the core-mantle boundary I am interested in a broad range of topics, including subduction zones, earthquake science, seismic hazards, structural geology, tectonophysics, and planetary interiors.

PROFESSIONAL EMPLOYMENT

Telemark Energy Services

June 2026 – present Seismological Contractor

Arizona State University

May 2025 – present Visiting Scholar
Oct. 2019 – May 2025 Doctoral Researcher & NSF Graduate Research Fellow

University of Nebraska-Lincoln

Aug. 2016 – Dec. 2018 Undergraduate Research Assistant

Australian National University / Incorporated Research Institutions for Seismology (IRIS) Consortium

May 2017 – Sep. 2017 Undergraduate Research Intern

PUBLICATIONS

Software:

1. **Richardson, C.** (2026) SITRUS (Seismic Iterative TomogRaphy Update Scheme). Available from Zenodo. <https://doi.org/10.5281/zenodo.21811452>
2. **Richardson, C.** (2025) EMPRESS (Earth Modeling PRioritized Event Selection Scheme). Available from Zenodo. <https://10.5281/zenodo.19225682>

Peer reviewed articles:

1. Garnero, E. J. & **Richardson, C.** (2024) The mysterious, massive structures in Earth's deep mantle. *Physics Today*. <https://doi.org/10.1063/pt.mzrx.ddag>

Submitted articles:

1. **Richardson, C.**, Garnero, E. J., Hansen, S. E. (submitted Aug. 2026 to *Geophysical Journal International*) Seismic Iterative TomogRaphy Update Scheme (SITRUS): A method and software package to update global seismic tomography models using travel time datasets.

In preparation:

2. **Richardson, C.**, Garnero E. J., Hansen, S. E., Ritsema, J., & Grand, S. P. (ant. 2026 submission) Updating global tomography models with a forward, iterative travel time mapping scheme.
3. **Richardson, C.**, Garnero, E. J., Bozdağ, E. (ant. 2026 submission) EMPRESS: a workflow to optimize event selection for regional seismic modeling.

Academic works:

1. **Richardson, C.** (2025) New Methods for Improving Global and Regional Seismic Models of Earth's Mantle (Publication No. 31847790) [Doctoral dissertation, Arizona State University]. ProQuest Dissertations & Theses.

SELECTED HONORS & AWARDS

2024 ASU Graduate Completion Fellowship
2023 ASU Graduate and Professional Student Association Service Award
2023 ASU College of Liberal Arts and Sciences Graduate Excellence Award
2022 ASU College of Liberal Arts and Sciences Student Leader Award
2021 NSF Graduate Research Fellowship
2018 Stracher Award for Excellence in Structural Geology and Metamorphic Petrology
2017 Outstanding Undergraduate Student (Geology)

FUNDING

Period	Amount	Source	Title/Description
2021-2025	\$108,000 + tuition & fees	NSF	Graduate Research Fellowship
2024-2026	\$25,600 + tuition	ASU Graduate College	Graduate Completion Fellowship
2024	\$4000	Seismological Society of America	Community Grant
2023	\$5000	Seismological Society of America	Community Grant
2014-2018	~\$80,000	University of Nebraska-Lincoln	Regents Scholarship (full tuition up to 120 credit hours)

PRESENTATIONS & SCIENCE COMMUNICATION

**Denotes invited event*

Presentations & colloquia

- 2026 **“Geophysical imaging, from calderas to the Core-Mantle Boundary”*
USGS Geology, Minerals, Energy, & Geophysics Science Center Seminar; Moffett Field, CA
- 2025 *“New methods for improving global and regional seismic models of Earth’s mantle”*
PhD defense; Tempe, AZ
- 2025 **“The mysterious, massive structures in Earth’s deep mantle”*
Washington State University Physics and Astronomy colloquium; virtual
- 2023 *“Updating global, whole mantle tomography models with an iterative forward mapping routine”*
ASU Geophysics Seminar Series; Tempe, AZ
- 2022 *“Seismic tomography: what comes next?” conference summary and steps forward in Earth modeling”*
ASU Geophysics Seminar Series; Tempe, AZ
- 2021 *“Leveling the field: making fieldwork in SESE more equitable and accessible”*
ASU School of Earth and Space Exploration colloquium; Tempe, AZ
- 2020 *“Cookies for justice: making STEM a better place for all”*
ASU Geophysics Seminar Series; Tempe, AZ
- 2020 *“Toward a comprehensive, high-quality dataset for global mantle imaging”*
ASU Geophysics Seminar Series; Tempe, AZ
- 2018 *“The Earth System”*
Freeman Public Schools (elementary classroom presentation), Adams, NE

Conference talks, posters & presentations

- 2024 **Richardson C.** & Garnero, E. J. *“Updating global, whole mantle tomography models with an iterative forward mapping scheme”, Arizona Collaborative Consortium for Earth and Space Sciences (talk)*

- 2024 **Richardson C.**, Garnero, E. J., Hansen, S. E., Ritsema, J., & Grand, S. P. “Comparing lowermost mantle seismic structure of global tomography models updated with a forward, iterative travel time mapping scheme”, Study of Earth’s Deep Interior meeting (poster)
- 2023 **Richardson, C.** & Garnero, E. J. “An iterative approach to update global whole-mantle tomography models using a large multi-phase shear wave dataset”, Interior of the Earth Gordon Research Conference (poster)
- 2023 **Richardson, C.** & Garnero E. J., “Updating global, whole mantle tomography models with an iterative forward mapping scheme”, American Geophysical Union Fall Meeting (eLightning presentation; abstract DI14A-09)
- 2021 **Richardson, C.**, Lai, H., & Garnero, E. J. “Development of a large, global, high quality dataset from an adaptive empirical wavelet method to sharpen deep mantle imaging”, Lamont-Doherty Seismology Student Workshop (virtual poster)
- 2018 **Richardson, C.**, Burberry, C. M., & Filina, I. “Geologic History of the New Caledonia Trough from Potential Fields Modeling and Tectonic Reconstruction”, American Geophysical Union (poster, abstract T41G-0379)
- 2017 **Richardson, C.**, Mousavi, S. S., Tkalčić, H., & Masters, G. “Transdimensional Bayesian tomography of the lowermost mantle from shear waves”, American Geophysical Union (poster, abstract DI31A-0384)
- 2017 **Richardson, C.** & Burberry, C. M. “Penetrative strain in a contractional orogenic system with ductile basal and intermediate detachments”, Nebraska Academy of Sciences annual meeting (poster)
- 2017 Burberry, C.M, Lathrop, B. A., & **Richardson, C.** “Using Penetrative Strain and Strain Partitioning to Resolve the “missing Shortening” Problem: Insights from Analog Models

Panels & media interviews

- 2025 **“Two buried ‘supercontinents’ hiding inside Earth could be much older than previously thought”*
Media interview (CNN article authored by Mindy Weisberger: <https://tinyurl.com/mtmxmkek>)
- 2023 “Early Career Geoscience Women in STEM”
Panelist-School of Earth and Space Exploration New Discoveries Lecture Series
- 2023 “A 2023 Journey to the Center of the Earth”
Keynote by Dr. E. Garnero
Panelist-Earth and Space Exploration Open House

LEADERSHIP, SERVICE, EQUITY, & ADVOCACY

NB: many of the following activities were performed in collaboration with some or all of the members of the given group. Where relevant, project/initiative lead(s) is listed.

Inclusive Community Committee member
Arizona State University

Aug. 2021-May 2025

- Collaborated with diverse groups (both internal and external) to work on a variety of community-identified initiatives

Claire Richardson CV

- Led listening sessions for the graduate student body to get input on current projects
- Regularly solicited community feedback on and update SESE's Strategic Plan
- Co-wrote the SESE code of conduct
- Improved the Ph.D. candidacy exam and overall program experience by developing standardized rubrics (lead: Dr. Christy. Till)
- Developed a Graduate Student Bill of Rights
- Revised and submitted three proposals for the American Geophysical Union Bridge Program

Arizona Collaborative Consortium for Earth and Space Science (ACCESS)

Jul. 2023 – Aug. 2024

Founder & co-chair

Arizona State University

- Initiated and led a collaborative geophysics consortium across three major public universities in Arizona (Arizona State University, Northern Arizona University, and University of Arizona)
- Scheduled, planned, and hosted regular monthly meetings, as well as our first annual, in-person meeting in January 2024 with funding from the SSA Community Grants program

SESE Graduate Council President

Sep. 2022 – Aug. 2023

Arizona State University

- Organized and facilitated Council interactions with faculty, staff, and other students for community events and student advocacy efforts
- Led monthly internal meetings and semesterly open meetings for the student body
- Liaised between department leadership and graduate students, including attending weekly faculty meetings and meetings with the Associate Director for Graduate Initiatives
- Revised and administered annual Graduate Student Satisfaction Survey
- Compiled and analyzed Survey results to present to the student body and department leadership
- Developed policy to include graduate students on faculty searches and hiring committees
- Co-organized and hosted:
 - o Annual Q&A panel for students preparing for their comprehensive exams
 - o Various SESE-wide community building events
 - o SESE alumni career panel (lead: Jayanth Serla)
 - o Monthly Queer-Trans coffee hour (lead: Alejandro Olvera)
 - o Prospective graduate student visitation weekend (leads: Heather Hewitt and Ebraheem Farag)
- Analyzed results from a previous TA workload survey to improve TA experiences (lead: Grace Beall)
- Developed an online interface for undergraduate research opportunities (lead: Erin Alexander)

SESE graduate peer mentor

Aug. 2022 – July 2023

Arizona State University

- Met regularly with a first year graduate student to familiarize them with academic, professional, social, and cultural aspects of graduate student life in SESE

ASU Graduate and Professional Student Association award reviewer

Aug. 2022 – Dec. 2022

Arizona State University

- Attended classes taught by graduate students and reviewed their performance based on a standardized rubric

ASU Geophysics Seminar Series chair

Nov. 2020 – Dec. 2022

Arizona State University

- Organized semester-long schedules for both internal and external speakers
- Communicated weekly speaker information and moderated weekly meetings

- Initiated invited speaker program, which targets early career and researchers from underrepresented groups

Miscellaneous service efforts:

- Lead facilitator for “Becoming Active Bystanders” Workshop (2020 – 2022)
- White paper submitted to ASU School of Earth and Space Exploration: “Leveling the playing field: making fieldwork in SESE and CLAS more equitable and accessible” (2020)

TEACHING & OUTREACH

Teaching

2025	Guest lecturer – Introduction to Geology <i>Arizona State University</i>
2020-2022	Geoscience instructor and curriculum developer <i>SESE Prison Education Program</i> <i>Arizona State University</i>
2021	Teaching assistant – Introduction to Geology <i>Arizona State University</i>
2017 – 2018	Private calculus tutor <i>University of Nebraska-Lincoln</i>
2017	Teaching assistant – Geological Natural Hazards <i>University of Nebraska-Lincoln</i>
2016	General Education Development (GED) instructor – Math <i>Southeast Community College</i>

Outreach

2022-2023	Science pen-pal <i>Letters to a Pre-Scientist</i>
2017, 2018	Earthquake station host <i>Dinosaurs & Disasters outreach event at the Nebraska State Museum</i>