

Brianna C. Birkel, Ph.D.

birkel@usc.edu | (425) 941-3121 | Albany, CA
Personal Website | Google Scholar | GitHub | LinkedIn

Education

University of Southern California – Ph.D., Geophysics and Seismology Aug 2026

- *Dissertation:* Multiscale Computational Modeling and Seismic Imaging Across Complex Geologic Domains
- *Advisory Committee:* John E. Vidale (Chair), David Okaya, Chukwuebuka C. Nweke
- *Areas of expertise:* Full-waveform earthquake simulations, geophysical data and signal processing, open-source software development and documentation, inverse problems, Bayesian inference, uncertainty quantification, machine learning, interdisciplinary collaboration, science communication

University of Washington – B.S., Physics with Interdisciplinary Honors June 2019

Awards and Honors

- **USC Provost Fellow** (2024–2025, \$109,900) – Research fellowship for “students whose combination of background and training will make a substantive, documentable, and unique contribution to the program as assessed by faculty.” Only one department fellowship awarded per cohort.
- **Statewide California Earthquake Center Research Award** (2021–2022, \$20,405) – Testing and improving SCEC Velocity Models for the Los Angeles Basin as a step towards more accurate hazard maps. SCEC Award #21165.
- **Statewide California Earthquake Center Research Award** (2020–2021, \$30,030) – Development and Implementation of Full 3-Dimensional Waveform Tomography Applied to the Greater Los Angeles Region. SCEC Award #20187.
- **UW Honors Undergraduate Scholar Award** (2014–2015, \$40,000) – Full-tuition annual merit scholarship through the University of Washington’s Interdisciplinary Honors Program, recognizing interdisciplinary learning, academic exploration, and community engagement.

Research Experience

Computational Geophysics Ph.D. Researcher, University of Southern California Aug 2019 – Aug 2026

- Developed Python, Bash, and Slurm workflows for 3D spectral-element ground-motion simulations using *Salvus* on high-performance computing clusters, resulting in robust validation of Southern California Community Velocity Models using multi-terabyte sets of observed and synthetic waveform data and a novel goodness-of-fit approach.
- Designed a novel mathematical framework for differential ambient noise tomographic imaging and tested it on synthetic benchmarks to demonstrate reduced model recovery error relative to traditional methods; applied this method as part of a multi-year NSF research project to characterize shallow subsurface structure relevant to fluid flow and landslide processes in the Nepal Himalaya.
- Developed an earthquake catalog locating microseismicity on the Main Himalayan Thrust using machine learning–based seismic phase picking, association, and double-difference relocation.

- Collaborated with scientists and engineers across the fields of geology, hydrology, environmental science, climate science, and civil engineering as part of several multidisciplinary research projects; presented computational seismology research at national and international conferences.

IRIS Seismology Research Intern, Stanford University

May – Sept 2018

- Adapted a complex similarity-search algorithm in Python and Bash to detect brittle-failure upper-mantle earthquakes below Harrat Rahat, Saudi Arabia as part of the Crustal Geophysics Group; presented results at the American Geophysical Union Annual Meeting in 2018.

Quantum Computing Research Assistant, University of Washington, Seattle

Jan – Sept 2016

- Characterized nitrogen-vacancy centers in diamond using optical polarization measurements, spectroscopy, and annealing experiments to assess fitness as qubit candidates in the Optical Spintronics and Sensing Lab.

Work Experience

AI Evaluator and Scientific Domain Expert Reviewer, Handshake AI

Sept 2026 – Present

- Design and test complex analytical benchmarks from real-world seismological data to assess models' scientific reasoning, developing comprehensive reference solutions and clear scoring rubrics.
- Evaluate AI-generated scientific analyses and presentations for technical accuracy, quantitative reasoning, and interpretation of evidence across physics, geoscience, and environmental science.
- Identify failure modes in AI-generated scientific content, including unsupported conclusions, methodological errors, inconsistent reasoning, and inaccurate interpretation of data and figures.
- Review and provide structured feedback on ambiguous or complex cases for other domain experts, helping improve the reliability and consistency of expert-supervised AI evaluation workflows.

Research Software and Documentation

Spatial Validation Toolkit for Ground Motion Simulations

github.com/bcbirke/spatial-vtk

- Built an open-source Python toolkit for comparing large sets of observed and synthetic seismograms, including tools for seismic waveform ingestion, preprocessing, data-quality assessment, goodness-of-fit calculation, diagnostic visualization and interactive dashboard creation.
- Wrote extensive documentation, tutorial notebooks, and reproducible example workflows to support adoption by other researchers.
- Implemented GitHub Actions workflows to run automated tests across Python versions, build and deploy Sphinx documentation, and publish versioned releases to PyPI.

Teaching and Community Engagement

Teaching Assistant, University of Southern California

Aug 2019 – May 2026

- Designed and led lab and discussion sections for Earth science and physics courses, including Earthquakes, Processes of Change in Science (Natural Hazards), Introduction to Geosystems, Oceanography, and Physics for the Life Sciences, translating technical physics and Earth-systems concepts for mixed-major undergraduate audiences.

- Used student-generated discussion questions and small-group activities to encourage critical reading, participation, and connections between course material and current events; created original curriculum exploring climate change, human impacts, and scientific policy.
- Earned a student-review rating of “excellent” (highest possible rating) from 78% of students in most recent physics course.
- Received an average score of 3.83 out of 4 in student evaluations for "carefully explaining difficult concepts, methods, and subject matter" and 3.73 out of 4 for "[being] receptive to the expression of diverse student viewpoints" in most recent Earth sciences course.

Departmental Curriculum Committee Member, USC Dept. of Earth Sciences Sept 2022 – May 2023

- Helped guide departmental decisions on upcoming courses, updating curricula, and supporting teaching assistants in laboratory settings.

Curriculum Design Volunteer, USC Joint Educational Project Oct 2021

- Designed and presented age-appropriate experiments about earthquake science and emergency preparedness for over 100 elementary school students in the Los Angeles Unified School District.

Engineer and Project Assistant, Engineers Without Borders, UW Chapter Sept 2015 – Aug 2016

- Contributed to the design and construction of cob-oven and wash-station shelters for UW Farm; developed a cost-effective budget for project materials and tools.

Technical Skills

- **Computing and Software Development:** Linux, Bash, high-performance computing, Slurm, Git/GitHub, CI/CD (GitHub Actions), Conda, SSH, Globus, Sphinx; familiar with Docker and OpenMP
- **Programming and Data Analysis:** Python (NumPy, SciPy, pandas, xarray, scikit-learn, Matplotlib, Plotly, Cartopy, Bokeh), JupyterLab/Notebook, MATLAB, VS Code, ParaView; familiar with R, Java, Fortran 77
- **Geophysical and Geospatial Packages:** Salvus, QGIS, geophysical Python packages (ObsPy, gmprocess, PhaseNet, Pyrocko, GeoPandas, QuakeMigrate, SeisLib)
- **Data Formats and Access:** miniSEED, SAC, StationXML, QuakeML, ASDF, HDF5, NetCDF, Parquet; FDSN web services, NHERI DesignSafe-CI

Selected Research Outputs

Publications

- Keating, S. A., Clark, M. K., Bickle, M. J., Chen, C.-M., Tipper, E. T., Okaya, D., Ramesh, S., Blunts, P., Atwood, A., Birkel, B. C., Zekkos, D., Chamlagain, D., and West, A. J. (2026). *The role of landsliding in steep mountain hydrology*. Revised manuscript currently under review at Nature Geoscience.
- Birkel, B. C. (2026). *Multiscale Computational Modeling and Seismic Imaging Across Complex Geologic Domains* [Doctoral dissertation, University of Southern California]. USC Digital Library. <https://doi.org/10.25549/USCTHESES-OUC1139903HY>
- Birkel, B. C. (2026). *Spatial-VTK: Spatial Validation Tools for Ground-Motion Simulations* (Version 0.1.4) [Computer software]. GitHub. <https://github.com/bcbirkel/spatial-vtk>.

Manuscripts in Preparation

Birkel, B. C., Vidale, J. E., and Nweke, C. C. "Validation of Community Velocity Models in Southern California Using 3D Ground Motion Simulations." *Manuscript in preparation*.

Birkel, B. C., Okaya, D., and Vidale, J. E. "Generalized Differential Ambient Noise Tomography." *Manuscript in preparation*.

Birkel, B. C., Okaya, D., Chen, C-M., and West, A. J. "Shallow Shear-Wave Velocity Structure Beneath the Melamchi Valley: Generalized Differential Ambient-Noise Tomography in Central Nepal." *Manuscript in preparation*.

Conference Presentations and Abstracts

Birkel, B. C., & Vidale, J. E. "Comparison of Observed and Simulated Ground Motions in the Los Angeles Basin Against Engineering Baselines." Presented at *Numerical Modeling of Earthquake Motions: Waves and Ruptures*, June 2024, Smolenice, Slovakia.

Birkel, B. C., Vidale, J. E., & Nweke, C. C. "Comparison of Observed and Simulated Ground Motions in the Los Angeles Basin." Presented at *AGU Fall Meeting*, December 2022, Chicago, IL. Abstract S45B-04.

Birkel, B. C., Vidale, J. E., Juarez, A., & Jordan, T. H. "Comparison of Ground Motions in Earthquakes with SCEC CVM Predictions." Presented at the *Southern California Earthquake Center Annual Meeting*, September 2020, Virtual.

Birkel, B. C., Vidale, J. E., Taborda, R., & Jordan, T. H. "Long-Period Earthquake Ground Motions in the Los Angeles Basin." Presented at *AGU Fall Meeting*, December 2019, San Francisco, CA. Abstract NH23A-08.

Birkel, B. C., Blanchette, A. R., Klemperer, S. L., Mooney, W. D., & Zahran, H. M. "Searching for Brittle-Failure Earthquakes in the Mantle Lithosphere Beneath Harrat Rahat, Saudi Arabia." Presented at *AGU Fall Meeting*, December 2018, Washington, DC. Abstract V13D-0134.