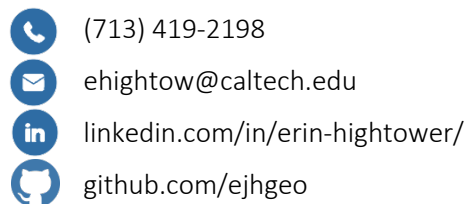


# ERIN HIGHTOWER, PhD

## GEOPHYSICIST



I am a geophysicist with expertise in geodynamic and finite-element modeling, gravity methods, Bayesian inverse methods, and crustal stress and seismicity, with experience modeling surface loading and mantle convection on parallel compute clusters. My research centers on the interactions between the solid earth, oceans, ice-sheets, and seismology and the implications these processes have for geohazards, surface water mass balance, and sea level rise. I aspire for my work to inform and support societal and economic resilience to natural hazards and climate change.

## EDUCATION

<b>PhD, Geophysics</b> California Institute of Technology <i>Dissertation Title: From Tectonic Evolution to Intraplate Stress: The Role of Structural Inheritance and Long-Wavelength Loading</i>	October 2023
<b>MS, Geophysics</b> California Institute of Technology	June 2020
<b>BA, Geology, Minor in Mathematics, <i>Summa Cum Laude</i></b> The Colorado College	May 2016

## RESEARCH EXPERIENCE

<b>Exploring the Signal of Glacial Isostatic Adjustment (GIA) in Geodetic Datasets</b> <ul style="list-style-type: none"><li>Quantifying the sensitivity of the solid earth response due to glacial unloading to 1D and 3D seismically constrained Earth structure using finite-element modeling of a viscoelastic planet</li><li>Testing and benchmarking the global finite element code <i>CitcomSVE</i> against existing GIA codes for future work on developing improved GIA corrections to global gravity data from GRACE</li></ul>	Caltech
<b>Modeling the Influence of Mantle Flow and Glacial Isostatic Adjustment on Seismicity in Eastern North America</b> <ul style="list-style-type: none"><li>Processed and analyzed global geospatial datasets using netCDF data formats and Python to build temperature and viscosity models of the North American continent for use in geodynamic models</li><li>Computed crustal stresses induced by long-wavelength mantle flow and the unloading of past ice-sheets using global finite-element convection and surface loading codes <i>CitcomS</i> and <i>CitcomSVE</i></li><li>Assessed fault stability in eastern North America using Coulomb failure stress analysis</li></ul>	Caltech
<b>Probabilistic Bayesian Gravity Inversion for Rock Density Modeling</b> <ul style="list-style-type: none"><li>Programmed a fully 3D Bayesian inversion software (BayGrav3D) for inverting satellite-derived gravity data for subsurface density structure</li><li>Constructed a 3D density model of offshore southern New Zealand using BayGrav3D and seismic priors collected and processed in collaboration with partners at the University of Texas</li></ul>	Caltech
<b>Statistical Analysis of Earthquake Interevent Times in Southern California</b> <ul style="list-style-type: none"><li>Reassessed the stationary Poisson assumption on earthquake occurrence by analyzing the interevent time distribution of data rich earthquake catalogs</li></ul>	Caltech

## TECHNICAL SKILLS

### Programming

- Python
- Matlab
- Bash
- GMT, NCO, ArcGIS, Xarray
- C/C++

### Data Analysis and Modeling

- Inverse Methods
- Bayesian Statistics
- Numerical/Finite-Element Modeling
- Parallel Computing
- Seismic Data Processing

### Software

- CitcomS and CitcomSVE
- Adobe Illustrator, Photoshop
- Microsoft Office
- LaTeX

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## PROFESSIONAL EXPERIENCE

- Caltech, Pasadena, CA | Postdoctoral Researcher** Jan. 2024 – Present
- Modeling the influence of 3D Earth structure on the solid earth response and gravitational signal of glacial unloading using CitcomSVE for application to GRACE data
- Petralogix Engineering, Inc., Galt, CA | Staff Geologist/Geophysicist** Oct. 2016 – Aug. 2017
- Characterized ground motion risk in Los Angeles, CA by analyzing ambient seismic noise with the Horizontal-Vertical-Spectral-Ratio method to determine fundamental site frequency
  - Compiled California Environmental Quality Act (CEQA) reports and groundwater antidegradation analyses for Patterson and Lodi, CA
- Smithsonian Institution, Global Volcanism Program (GVP), Washington D.C. | Geoscience Intern** June – Sept. 2016
- Categorized over 1000 volcanoes in the GVP global volcano database according to volcanic arc and magmatic province through extensive literature research and Google Earth mapping
- Energy XXI, Houston, TX | Geoscience Intern** June – Aug. 2014
- Correlated well log data and built a database using the mapping software Petra
  - Constructed structural maps and net sand isopachs to model an oil reservoir in the Gulf of Mexico and communicated scientific findings to senior management

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## HONORS AND AWARDS

- National Science Foundation Graduate Research Fellowship Awarded 2019
- Summa Cum Laude, Colorado College Awarded 2016
- The Phi Beta Kappa Society Inducted 2016
- Rocky Mountain Association of Geologists Neal J. Harr Outstanding Student Award Awarded 2016
- Colorado College Trustee Scholarship 2012-2016
- Colorado College Geology Department Witter Family Scholarship for Internships in Geology Awarded 2016
- Colorado College Geology Department William A. Fischer Scholarship Awarded 2015
- Alpha Lambda Delta National Honor Society Inducted 2013
- The Cum Laude Society Inducted 2012
- Sewanee Book Award for Excellence in Writing Awarded 2011

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## OUTREACH, MENTORING, AND LEADERSHIP

- Earthquake Fellows Program | Caltech** Summer 2022
- Designed presentations, lesson plans, assignments, and a field trip in collaboration with 3 other graduate students, a high school coordinator, and Dr. Lucy Jones for the inaugural year of the Earthquake Fellows High School Summer Program at Caltech
  - Mentored and taught 12 high school students from local Pasadena public schools on topics in seismology, as well as the college and graduate school experience
  - Helped students build Raspberry Shake seismometers to monitor seismicity from their homes
  - Advised a group of 4 students through a research project on local site response to earthquake shaking and the ambient noise Horizontal-Vertical-Spectral-Ratio method
- Summer Undergraduate Research Fellow (SURF) Student Mentor | Caltech** Summer 2021
- Mentored a SURF student intern on a research project aiming to reconcile estimates of sediment density at Gale Crater on Mars by jointly inverting Martian satellite gravity data and along track gravimetry measurements from the Curiosity rover mission
  - Oversaw a beta test of my 3D gravity inversion code (BayGrav3D) applied to coarser data sets and other planetary bodies
- Invited Discussion Leader | GeoPRISMS Synthesis Workshop | AGU** December 2019
- Organized discussions for the “*Strategies for Synthesis, Integration, and Future Opportunities*” Workshop
  - Coordinated breakout sessions on synthesis and dissemination of the vast array of data and knowledge gained by research under the GeoPRISMS and MARGINS decadal programs

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## PUBLICATIONS

- **Hightower, E.**, Mao, W., and Gurnis, M., Influence of Farallon Slab Loading on Intraplate Stress and Seismicity in Eastern North America in the Presence of Pre-Existing Weak Zones: *Geochemistry, Geophysics, Geosystems* [*submitted*]
- **Hightower, E.** and Gurnis, M., Influence of Glacial Isostatic Adjustment on Intraplate Stress and Seismicity in Eastern North America in the Presence of Pre-Existing Weak Zones: *Geochemistry, Geophysics, Geosystems* [*in prep*]
- **Hightower, E.**, Gurnis, M., and Van Avendonk, H. (2020), A Bayesian 3-D linear gravity inversion for complex density distributions: application to the Puysegur subduction system: *Geophysical Journal International*, v. 223, p. 1899-1918.
- Shuck, B., Gulick, S. P., Van Avendonk, H., Gurnis, M., Sutherland, R., Stock, J., and **Hightower, E.** (2022), Stress transition from horizontal to vertical forces during subduction initiation: *Nature Geoscience*, v. 15, p. 149-155.
- Shuck, B., Van Avendonk, H., Gulick, S.P.S., Gurnis, M., Sutherland, R., Stock, J., Patel, J., **Hightower, E.**, Saustrop, S., Hess, T. (2021), Strike-slip Enables Subduction Initiation Beneath a Failed Rift: New Seismic Constraints from Puysegur Margin, New Zealand: *Tectonics*, v. 40, no. 5.
- Patel, J., Sutherland, R., Gurnis, M., Van Avendonk, H., Gulick, S.P.S., Shuck, B., Stock, J., and **Hightower, E.** (2020), Stratigraphic architecture of Solander Basin records Southern Ocean currents and subduction initiation beneath southwest New Zealand: *Basin Research*, v. 33, p. 403-426.
- Gurnis, M., Van Avendonk, H., Gulick, S.P.S., Stock, J., Sutherland, R., **Hightower, E.**, Shuck, B., Patel, J., Williams, E., Kardell, D., Herzig, E., Idini, B., Graham, K., Estep, J., and Carrington, L. (2019), Incipient subduction at the contact with stretched continental crust: The Puysegur Trench: *Earth and Planetary Science Letters*, v. 520, p. 212-219.
- **Hightower, E.** and Shuck, B. (2018), SISIE: South Island Subduction Initiation Experiment: *GeoPRISMS Newsletter*, No. 40, p. 28-30.

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## PRESENTATIONS

- **Hightower, E.** and Gurnis, M. (2023, Dec. 11-15). *Influence of Farallon Slab Loading on Intraplate Stress and Seismicity in Eastern North America in the Presence of Pre-existing Weakzones* [oral presentation]. In Structure, Tectonics, and Seismicity of Cratons II Oral [session], AGU Fall Meeting, San Francisco, CA, T13B-02.
- **Hightower, E.** and Gurnis, M. (2023, Dec. 11-15). *Influence of Glacial Isostatic Adjustment on Intraplate Stress and Seismicity in Eastern North America in the Presence of Pre-existing Weakzones* [oral presentation]. In Investigations of Ice Sheets, Solid Earth, and Sea Level from a Glacial Isostatic Adjustment Perspective I Oral [session]. AGU Fall Meeting, San Francisco, CA, C11B-03.
- **Hightower, E.**, Gurnis, M., and Mao, W. (2023, July 3-7). *Influence of Farallon Slab Loading vs. GIA on the Intraplate Stress Field of Eastern North America: Implications for Intraplate Seismicity* [poster]. POLINET 2023 Glacial Isostatic Adjustment Training School, Gävle, Sweden.
- **Hightower, E.**, Gurnis, M., and Mao, W. (2022, Dec. 12-16). *Influence of Farallon Slab Loading on the Intraplate Stress Field of Eastern North America: Implications for Intraplate Seismicity*. In Structure, Tectonics, and Earthquake Hazards of Cratons IV Poster [session]. AGU Fall Meeting, Chicago, IL, Poster #T25D-0154.
- **Hightower, E.**, Gurnis, M., Van Avendonk, H., Sutherland, R., Shuck, B., Li, Y., Gulick, S., and Stock, J. (2020). *Transition in Force Balance during Puysegur Subduction Initiation: Three-dimensional Gravity and Dynamic Models* [eLightning presentation]. In Subduction Initiation: Modern Processes, Ancient Products, and Numerical Models [session]. AGU Virtual Fall Meeting, V045-07.
- **Hightower, E.**, Gurnis, M., Van Avendonk, H., Stock, J., Gulick, S., and Sutherland, R. (2019, Dec. 9-13). *A 3D Bayesian Gravity Inversion of the Puysegur Trench, New Zealand, with Insights into Subduction Initiation* [poster]: In Application of Gravity, Magnetic, and Heat Flow Data to Tectonic Studies II Posters [session]. AGU Fall Meeting, San Francisco, CA, Poster #T23C-0462.
- **Hightower, E.** and Avouac, J.-P. (2019, Sept. 8-11). *Revisiting the Earthquake Interevent Time Distribution and the Poisson Model with the QTM Catalog for Southern California* [poster]. SCEC Annual Meeting, Poster #035.
- **Hightower, E.**, Gurnis, M., Van Avendonk, H., Stock, J., Gulick, S., Sutherland, R., and Shuck, B. (2019, Feb. 26 – Mar. 1). *Gravitational Modeling of Crustal Structure and Composition of the Puysegur Margin, South Island, New Zealand: Insights into Subduction Initiation* [poster]. GeoPRISMS Synthesis Theoretical and Experimental Institute, San Antonio, TX.

- **Hightower, E.**, Gurnis, M., Van Avendonk, H., Stock, J., Gulick, S., Sutherland, R., and Shuck, B. (2018, Dec. 10-14). *Gravitational Modeling of Crustal Thickness and Lithospheric Structure of the Puysegur Trench, South Island, New Zealand: Insights into Subduction Initiation* [poster]. In Exploring Subduction Initiation Processes and Subduction Zone Dynamics: New Insights from Scientific Drilling, Marine Geophysics, and Ophiolites II Posters [session]. AGU Fall Meeting, Washington D.C., Poster #T51E-0207.
- **Hightower, E.** and Avouac, J.-P. (2018, Dec.) *The Earthquake Interevent Time Distribution: Testing the Poisson Assumption and the Brownian Passage Time Model* [poster]: Geomechanics and Mitigation of Earthquake Hazards Workshop, Caltech, Pasadena, CA.