

DANIEL ANDREW FROST

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Education

- Ph.D. The University of Leeds 2010-2014
Thesis: "Seismic observation of the Earth's small-scale structure"
Structure of lower mantle using scattered seismic waves and relation to large-scale features
Detecting the edge of the Pacific Large Low Shear Velocity Province using P-waves
- MEarthSci The University of Oxford 2006-2010
Earth Sciences 2.1 Classification
Masters thesis: "A marine geophysical study of the Tonga Trench-Louisville ridge collisional system in the South-West Pacific Ocean"

Employment

- Assistant Project Scientist University of California, Berkeley 2019-present
Funded by NSF grant 1829283: Resolving the influence of mantle heterogeneity on estimates of inner core anisotropy, and NSF grant 2027181: Collaborative Research: Towards improved imaging of the outermost core through determination of the effects of lowermost mantle heterogeneity and anisotropy, and NSF grant 2050011: Imaging deep mantle structure beneath Alaska using full waveform tomography
Understanding structure and tectonics of mantle beneath Alaska
Implementing regional box tomography
Improving resolution of deep Earth by understanding shallow mantle influence
- Postdoctoral Scholar University of California, Berkeley 2016-2019
Funded by NSF grants 1135452 and 1829283: Resolving the influence of mantle heterogeneity on estimates of inner core anisotropy
Inner core anisotropy using exotic seismic phases and seismic arrays and mineral physics
Supporting the research output and organisation of the Cooperative Institute for Dynamic Earth Research (CIDER) program
Preparing educational reports on multidisciplinary topics for CIDER
PDRA: Barbara Romanowicz
- Postdoctoral Scholar Arizona State University 2014-2016
Funded by NSF grant PVS0695: Deep mantle cycling of oceanic crust
Distribution of small-scale heterogeneities throughout both the upper and lower mantle and their relation to mantle dynamics and subduction
The influence of broad lower mantle heterogeneities on deep-travelling S-waves and the effect on analysis of outer core structure
PDRA: Edward Garnero

Research Interests

Whole Earth structure, earth evolution, cross-disciplinary studies, influence of convection on mantle structure, seismic scattering, core structure, anisotropy, chemical heterogeneity, D'' complexity, array seismology, tomographic inversion, developing seismic methodologies

Publications

Frost, Daniel A.; Romanowicz, Barbara; Lasbleis, Marine; Chandler, Brian: Dynamic history of the inner core constrained by seismic anisotropy, *in press at Nature Geoscience*

Frost, Daniel A.; Avery, Margaret S.; Buffett, Bruce A.; Chidester, Bethany A.; Deng, Jie; Dorfman, Susannah M.; Li, Zhi; Liu, Lijun; Lv, Mingda; Martin, Joshua F.: Multidisciplinary constraints on the thermal-chemical boundary between Earth's core and mantle, *in review at G3*

Frost, Daniel A.; Romanowicz, Barbara: Effects of upper mantle structure beneath Alaska on core wave absolute and differential measurements: implications for estimates of inner core anisotropy, 2021, 315, 106713

McMahon, Sean; Ivarsson, Magnus; Wacey, David ; Saunders, Martin; Belivanova, Veneta; Muirhead, David; Knoll, Pamela; Steinbock, Oliver; **Frost, Daniel A.**: Dubiofossils from a Mars-analogue subsurface palaeoenvironment: the limits of biogenicity criteria, 2021

Frost, Daniel A.; Romanowicz, Barbara; Roecker, Steve: Upper mantle slab under Alaska: contribution to anomalous core-phase observations on South Sandwich to Alaska paths, *Phys. Earth. Planet. Int.*, 2020, 299, 106427

Frost, Daniel A.; Romanowicz, Barbara: On the orientation of the fast and slow directions of anisotropy, *Phys. Earth Planet. Int.*, 2019, 286, p. 101-110

Frost, Daniel A.; Garnero, Edward J.; Rost, Sebastian, Dynamical links between small- and large-scale mantle heterogeneity: seismological evidence, *Earth Planet. Sci. Lett.*, 2018, 482, p. 135-146

Frost, Daniel A.; Romanowicz, Barbara, Constraints on Inner Core anisotropy using array observations of $P'P'$, *Geophys. Res. Lett.*, 2017, 44, p. 10,878-10,886

Frost, Daniel A.; Rost, Sebastian; Garnero, Edward J.; Li, Mingming; Seismic evidence for Earth's crusty deep mantle, *Earth Planet. Sci. Lett.*, 2017, 470, p. 54-63

Rader, Erika; Emry, Erica; Schmerr, Nicholas; **Frost, Daniel A.**; Cheng, Cheng; Menard, Julie; Yu, Chunquan; Geist, Dennis, Characterization and Petrological Constraints of the Midlithospheric Discontinuity, *G-Cubed*, 2015, p. 3484-3504

Rost, Sebastian; Earle, Paul S.; Shearer, Peter M.; **Frost, Daniel A.**; Selby, Neil D; Seismic Detections of small-scale heterogeneities in the deep Earth, *Springer Monograph*, 2015, in *The Earth's Heterogeneous Mantle*, c. 12, p. 367-390

Frost, Daniel A.; Rost, Sebastian; The P-wave Boundary of the Large-Low Shear Velocity Province beneath the Pacific, *Earth Planet. Sci. Lett.*, 2014, 403, p. 380-392

Frost, Daniel A.; Rost, Sebastian; Selby, Neil D.; Stuart, Graham W., Detection of a tall ridge at the core-mantle boundary from scattered PKP energy, *Geophys. J. Int*, 2013, 195, p. 558-574

Publications - in preparation

Frost, Daniel A.; Garnero, Edward J.: The influence of lower mantle structure on resolution of the Earth's core

Rost, Sebastian; **Frost, Daniel A.**, Nowacki, Andrew; Cobden, Laura: Hawaiian plume structure from Pdiffracted ray-path anomalies

Frost, Daniel A.; Waszek, Lauren: The sharpness of the inner core hemispheres: assessing the impact of the upper mantle on PKiKP

Frost, Daniel A.; Rost, Sebastian: Physical properties of scattering heterogeneities throughout the mantle

Non-peer reviewed work

Frost, Daniel A.; Romanowicz, Barbara: On the different flavours of seismic reference models, <https://escholarship.org/uc/item/7wb6377n>

Invited Presentations

2017 European Geophysical Association General Assembly Vienna

Frost, Daniel A.*; Rost, Sebastian; Garnero, Edward J.; Romanowicz, Barbara; The dynamic connection between small and large-scale mantle heterogeneity

2015 American Geophysical Union Fall Meeting San Francisco

Frost, Daniel A.*; Rost, Sebastian; Garnero, Edward J.; Seismic detection of oceanic crust in Earth's lower mantle and its relation to large-scale mantle structure

2013 European Geophysical Association General Assembly Vienna

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; A global study of the lowermost mantle using scattered PKKP waves (PK•KP)

2012 Faculty of Environment Conference Leeds

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; Stewart, Graham W.; The Earth in detail: Seismology as a tool for studying the Earth's fine-scale structure

2012 Congres de Doctorants IGP, Paris

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; Stuart; PKP Scattering: Detecting a Heterogeneous Ridge Above the Core-Mantle Boundary

Campus Presentations

2020 Geophysics seminar Scripps Institution of Oceanography

Frost, Daniel A.*; Dynamic history of the inner core constrained by seismic anisotropy

2020 Department seminar Durham University

Frost, Daniel A.*; Dynamic history of the inner core constrained by seismic anisotropy

2019 Berkeley Seismological Laboratory Seminar UC Berkeley

Frost, Daniel A.*; Dynamic history of the inner core constrained by seismic anisotropy

2019 Department seminar Mississippi State University

Frost, Daniel A.*; Detecting the growth rings of Earth's core with seismology

2019 Origins Seminar UC Davis

Frost, Daniel A.*; Seismological evidence of the dynamical links between small- and large-scale mantle structure

2019 Seismology and Tectonics Seminar UCLA

Frost, Daniel A.*; Inner core dynamics from patterns of seismic anisotropy

2018 Seismological Laboratory Seminar California Institute of Technology
Frost, Daniel A.*; Seismological evidence of the dynamical links between small- and large-scale mantle structure

2018 Department of Physics Colloquium New Mexico State University
Frost, Daniel A.*; The dynamical links between small- and large-scale mantle structures: seismological evidence

2016 Deep Thoughts Earth and Life Science Institute, Tokyo
Frost, Daniel A.*; Seismically mapping kilometre-scale structures throughout the mantle

2016 Berkeley Seismological Lab Seminar University of California, Berkeley
Frost, Daniel A.*; Seismically mapping kilometre-scale structures throughout the mantle

Proposals - funded

2021 National Science Foundation CSEDI program
 Value: \$408,190 *Collaborative Research: The Origins and Implications of Inner Core Seismic Anisotropy*
 Myself as PI with Bruce Buffett (UC Berkeley), and Lowell Miyagi (University of Utah) as CoIs

2021 National Science Foundation Geophysics program
 Value: \$221,284 *Imaging deep mantle structure beneath Alaska using full waveform tomography*
 Myself as PI, with Barbara Romanowicz (UC Berkeley) as CoI.

2020 National Science Foundation Geophysics program
 Value: \$72,612 *Collaborative Research: Towards improved imaging of the outermost core through determination of the effects of lowermost mantle heterogeneity and anisotropy*
 Myself as CoI with Edward Garnero (Arizona State University) as PI, and CoIs Ebru Bozdog (Colorado School of Mines) and Maureen Long (Yale University).

2018 National Science Foundation Geophysics program
 Value: \$152,142 *Resolving the influence of mantle heterogeneity on estimates of inner core anisotropy*
 Co-authored with Barbara Romanowicz. Named researcher.

2014 National Science Foundation Cooperative Studies Of The Earth's Deep Interior program
 Value: \$550,121 *Deep Mantle Cycling of Oceanic Crust*
 This proposal was authored by PIs at ASU, but the seismological investigations (one third of the proposed activities) were built around my skill base, to specifically fund my involvement in the multidisciplinary research

2014 Preparatory Commission for the Comprehensive Nuclear Test-ban Treaty Organization (CTBTO) Young Scientist Research Award
 Value: 9 months *Characterisation of small-scale heterogeneities beneath IMS arrays for improved source location and magnitude estimation*
 Authored proposal and the project was awarded, but I turned this down to accept a postdoctoral position at Arizona State University

Teaching Experience

University of California, Berkeley

Postdoc Teaching Opportunities Program Learner-centered teaching course (May 2020)

Pathways to Scientific Teaching training course (Feb 2020)
 Guest instructor: Earthquake of the week EPS 256 (2018, 2019) - Graduate level
 Guest lecturer: Physics of the Earth's Interior EPS122 (2017)

Arizona State University

Undergraduate student pitching workshop (2015)

The University of Leeds

Teaching assistant: Global Seismology (2011, 2012, 2013)
 Guest lecture on graduate research: Global Seismology (2013)
 Teaching assistant: Computing (2011, 2012, 2013)
 Teaching assistant: Geological fieldwork courses (2011, 2012, 2013)
 Teaching assistant: Petrology (2013)
 Teaching assistant: Inverse theory (2012)
 Teaching assistant: Geological map skills (2012)
 Teaching assistant: Applied geophysics (2011)
 Teaching assistant: Geophysical data acquisition field course (2011)

Multidisciplinary Research Experience

2018 CIDER Summer School UC Santa Barbara, California
 "Relating geophysical and geochemical heterogeneity in the deep Earth" (attendant)
 Worked to constrain the nature of the thermal boundary layer at the core-mantle boundary from a multidisciplinary approach

2017 MEXT Shin-Gakujutsu Winter Kusatsu, Japan
 school
 "Origin and Evolution of Deep Primordial Reservoirs" (attendant)

2016 CIDER Summer School UC Santa Barbara, California
 "Flow in the Deep Earth" (attendant)
 Worked on integrating multidisciplinary observations and experiments of the lower mantle to understand its chemical and thermal structure

2014 ELSI Summer School Earth and Life Sciences Institute, Tokyo
 "Computational Tools for Planetary Formation and Earth Evolution" (attendant)

2013 Seismic network deployment
 Assisted in decommissioning Faultlab Dense Array in Northern Anatolia in Turkey

2013 CIDER Summer School UC Berkeley, California
 "From mantle to crust: continental formation and destruction" (attendant)
 Worked on the nature, prevalence, and possible explanations for observations of the Mid-Lithospheric Discontinuity

2010, 2012 Research Scientist AWE Blacknest, UK
 Analysed seismic scattering using CTBTO data

2009 Volunteer Research Scientist Centre of Exchange and Research in Volcanology, Colima University, Mexico
 Volunteered as a research assistant for 2 months working with seismic data and thermal camera images to analyse volcanic activity at Volcan de Colima. Took part in several field trips to observe and sample Volcan de Colima

Mentoring Experience

Co-mentoring PhD student Adeolu Aderoju with Ed Garnero at Arizona State University (2020-onwards)
 UC Berkeley Compass undergraduate student mentor (Fall 2020)
 Student mentor at the American Geophysical Union Fall Meeting (2017-2019)

Scientific Service

Reviewer: Earth and Planetary Science Letters, Journal of Geophysical Research, Geophysical Journal International, Geophysical Research Letters (Editor's Citation for Excellence in Refereeing, 2019), Seismological Research Letters

2021	Session co-convener at upcoming American Geophysical Union Fall Meeting
2020	Session co-convener at American Geophysical Union Fall Meeting
2020	American Geophysical Union Fall Meeting OSPA Liaison
2015-2020	American Geophysical Union Fall Meeting OSPA Judge
2016-2019	Maintaining CIDER's online presence
2019	Supported the organisation of CIDER summer program
2018	Organised CIDER pre-AGU workshop
2018	Supported the running and organisation of CIDER summer program
2017	Co-organised CIDER pre-AGU workshop
2017	Assisted with running CIDER summer program
2016	Organised student pitching competition at Arizona State University
2012	Assisted with delegate services for the SEDI 2012 meeting held in Leeds
2012	Co-organised the British Geophysical Association Postgraduate Research in Progress Meeting held in Leeds

Service to University

2020-2021	Member of Earth and Planetary Sciences URGE pod contributing to justice, equity, diversity, inclusion, and access deliverables for use in department's strategic plan
2020-2021	Member of Berkeley Seismological Laboratory Outreach & Diversity Equity Inclusion Accessibility work group
2019	Co-organised Berkeley Seismological Lab seminar series
2018	Organised lab-wide discussion meetings on recent seismicity and professional development
2017	Postdoc representative on UC Berkeley Seismological Lab web design committee
2016	Co-organised Berkeley Seismological Lab seminar series
2015	Organised research group-wide social meetings at Arizona State University
2013	Postgraduate student representative at both the research institute and school level at University of Leeds

Outreach

Spring 2021	Remotely taught seismology and about careers to 4th and 5th grade students in Tracy, California
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Fall 2020	Contributed to public lecture series for NSF-funded grant
February 2020	Presented research and about science careers at Berkeley City College
2019	Popping the Science Bubble - public research talk at Berkeley Public Library
2019	Remotely taught seismology to 3rd and 4th grade students at school in central Kansas
2019	Presented research and basic seismology lesson to 7th grade students visiting from local school
2019	Presented at UC Berkeley CalDay on Earth's core to advertise geophysics research to prospective students
2019	Support Berkeley Seismological Laboratory at UC Berkeley CalDay
2019	Taught tectonics to 6th grade students with Bay Area Science in Schools
2019	Remotely engaged with third grade students at a rural school to discuss earthquake hazards and research
2018	Engaged with the public at a question and answer session at The Bay Area Science Festival
2018	Presented on behalf of UC Berkeley Seismological Lab at the City of Berkeley ShakeOut
2018	Presented at UC Berkeley Compass to advertise geophysics research across campus
2018	Presented at UC Berkeley CalDay on Earth's core to advertise geophysics research to public
2018	Supported Berkeley Seismological Laboratory at UC Berkeley CalDay
2018	Taught statistical analysis to students for science fair projects in a Bay Area middle school
2018	STEM mentor for Be A Scientist program in a Bay Area middle school
2017	Taught seismology to 6th grade students with Bay Area Science in Schools
2017	Presented on behalf of UC Berkeley Seismological Lab at the Bay Area Science Festival

Professional Development

2020	University of California, Diversity, Equity, and Inclusion Discussion Group Postdoc discussion of inclusion in STEM education
2018	University of California, Beyond Diversity lectures Discussion of inclusion in STEM education
2016	University of California, Berkeley Postdoctoral Development Courses Management and Python programming
2015	Arizona State University Postdoctoral Development Course Pitching and application writing
2015	IRIS Webinars Programming skills and career development

Presentations

2020	American Geophysical Union Fall Meeting	San Francisco
	Frost, Daniel A.* ; Romanowicz, Barbara; Upper mantle structure beneath Alaska: implications for inner core anisotropy studies from analysis of PKP _{df} , bc, ab absolute and differential measurements	
2019	American Geophysical Union Fall Meeting	San Francisco

Frost, Daniel A.*; Romanowicz, Barbara; Lasbleis, Marine; Chandler, Brian; Seismic evidence of slow translation of the iron-nickel inner core

2019 American Geophysical Union Fall Meeting San Francisco

Frost, Daniel A.*; Romanowicz, Barbara; Roecker, Steve; Upper mantle slab beneath Alaska: major contribution to the South Sandwich to Alaska anomalous PKP observations

2019 IUGG General Assembly Montreal

Frost, Daniel A.; **Romanowicz, Barbara***; Chandler, Brian; Lasbleis, Marine; Seismic evidence of slow translation of the inner core

2018 American Geophysical Union Fall Meeting Washington D.C.

Frost, Daniel A.*; Romanowicz, Barbara; Lasbleis, Marine; Chandler, Brian; Inner Core Dynamics From Patterns of Seismic Anisotropy

2018 American Geophysical Union Fall Meeting Washington D.C.

Roecker, Steven; **Frost, Daniel A.***; Romanowicz, Barbara; Structure of the Crust and Upper Mantle beneath Alaska Determined from the Joint Inversion of Arrival Times and Waveforms of Regional and Teleseismic Body Waves

2018 American Geophysical Union Fall Meeting Washington D.C.

Mingda Lv, Margaret S Avery, Xiaoran Chen, Bethany Chidester, Jie Deng, Benjamin J Farcy, **Frost, Daniel A.***, Zhi Li, Joshua F Martin, Bruce A Buffett, Susannah Dorfman, and Lijun Liu: ; A multidisciplinary assessment of heat flux at the core mantle boundary

2018 American Geophysical Union Fall Meeting Washington D.C.

Waszek, Lauren; Burdick, Scott; Lasbleis, Marine; **Frost, Daniel A.***; Anandawansa, Rashni; Combining global tomographic inversions with geodynamical growth models to constrain the origins of Earth's inner core features

2018 Study of Earth's Deep Interior Edmonton

Frost, Daniel A.*; Romanowicz, Barbara; Axially dependent Inner Core anisotropy from low order inner core convection

2018 Dynamics and evolution of Earth's coupled core-mantle system Royal Astronomical Society

Frost, Daniel A.*; Romanowicz, Barbara; Axially dependent Inner Core anisotropy from low order inner core convection

2017 American Geophysical Union Fall Meeting New Orleans

Frost, Daniel A.*; Romanowicz, Barbara; Investigating the source of anomalous PKP travel times on South-Sandwich to Alaska paths

2017 Gordon Research Conference: Interior of the Earth Mount Holyoke

Frost, Daniel A.*; Romanowicz, Barbara; Constraints on Inner Core structure from P'P' array-based observations

2017 Gordon Research Seminar: Interior of the Earth Mount Holyoke

Frost, Daniel A.*; Romanowicz, Barbara; Constraints on Inner Core structure from P'P' array-based observations

2017 European Geophysical Association General Assembly Vienna

Frost, Daniel A.*; Romanowicz, Barbara; Constraints on Inner Core structure from P'P' array-based observations

2016 American Geophysical Union Fall Meeting San Francisco

Frost, Daniel A.*; Romanowicz, Barbara; Constraints on Inner Core structure from P'P' array-based observations

- 2016 American Geophysical Union Fall Meeting San Francisco
 Ko, Byeongkwan; Holt, Adam; Gao, Chao; **Frost, Daniel A.***; Karaoglu, Haydar; Lai, Hongyu; Yuan, Kaiqing; Li, Mingming; Campbell, Siobhan M.; Shim, Sang-Heon; Irving, Jessica C. E.; Kellogg, Louise H.; Miller, Samantha M.; Probing the lower mantle composition and thermal structure: Insights from D''
- 2016 Study of Earth's Deep Interior Nantes
Frost, Daniel A.*; Garnero, Edward J.; Rost, Sebastian; Connection across scales of seismic heterogeneity throughout the mantle
- 2015 American Geophysical Union Fall Meeting San Francisco
Frost, Daniel A.*; Garnero, Edward J.; TA sub-array measurements of SmKS ray parameters to determine lower mantle influence
- 2014 American Geophysical Union Fall Meeting San Francisco
Frost, Daniel A.*; Rost, Sebastian; Garnero, Edward J.; A dynamical context for small-scale heterogeneity throughout the mantle beneath subduction
- 2014 Study of Earth's Deep Interior Kanagawa, Japan
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; A global study of the lowermost mantle using short and long period scattered PKKP waves (PK●KP)
- 2013 American Geophysical Union Fall Meeting San Francisco
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; A global study of the lowermost mantle using short and long period scattered PKKP waves (PK●KP)
- 2013 American Geophysical Union Fall Meeting San Francisco
Frost, Daniel A.*; Rost, Sebastian; Constraining lower mantle anomalies using USArray
- 2013 American Geophysical Union Fall Meeting San Francisco
 Rost, Sebastian; **Frost, Daniel A.***; The distribution of small-scale heterogeneity at the core-mantle boundary
- 2013 BGA Postgraduate Research in Progress Meeting Cambridge
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; A global study of the lowermost mantle using scattered PKKP waves (PK●KP)
- 2013 Gordon Research Conference: Interior of the Earth Mount Holyoke
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; A global study of the lowermost mantle using scattered PKKP waves (PK●KP)
- 2013 Gordon Research Seminar: Interior of the Earth Mount Holyoke
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; Stewart, Graham W.; PKP Scattering: Detecting a Heterogeneous Ridge Above the Core-Mantle Boundary
- 2012 Structure and Dynamics of Earth's Deep Mantle College de France
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; PKKP Scattering: A tool for the global study of the Core-Mantle Boundary
- 2012 BGA Postgraduate Research in Progress Meeting Leeds
Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; PKKP Scattering: A tool for the global study of the Core-Mantle Boundary
- 2012 Study of Earth's Deep Interior Leeds

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; PKKP Scattering: Towards a global study of the Core-Mantle boundary

2011 American Geophysical Union Fall Meeting San Francisco

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; Stuart, Graham W., PKP Scattering: Detecting a heterogeneous ridge about the Core-Mantle boundary

2011 BGA Postgraduate Research in Progress Meeting Oxford

Frost, Daniel A.*; Rost, Sebastian; Selby, Neil D.; Stuart, Graham W., PKP Scattering: Detecting a heterogeneous ridge about the Core-Mantle boundary