

Carl Ulberg, Ph.D.

3817 S Andover St.
Seattle, WA 98118

(206) 227-1234
carlulberg@gmail.com
github.com/ulbergc
linkedin.com/in/carlulberg

EDUCATION

- 2011-2018 University of Washington, Seattle, WA
Ph.D., Department of Earth and Space Sciences, GPA 3.97
- 2003-2007 Carleton College, Northfield, MN
B.A., Geology (Distinction in major), GPA 3.76, Magna Cum Laude

PROFESSIONAL EXPERIENCE

- 2018-Present **Research Associate**
Department of Earth and Space Sciences, University of Washington, Seattle, WA
Supervisor: Ken Creager
- Perform seismic tomographic inversions incorporating active source and local earthquake data sets. Collaborate on field work opportunities and data collection/management with researchers at University of Washington, University of Arizona, Cornell University, USGS-CVO, USGS-GGGSC. Teach ESS 314-Geophysics in Fall quarter, 2018.*
- 2011-2018 **Graduate Research Assistant**
Department of Earth and Space Sciences, University of Washington, Seattle, WA
Supervisor: Ken Creager
- Conducted research on source amplitudes of tectonic tremor in northern Cascadia and seismic velocity structure of the Mount St. Helens region. Organized and led the deployment, data collection, and equipment recovery of a 70-element broadband array at Mount St. Helens, WA. Supervised undergraduate students in seismic research, data processing, and field experiments.*
- 2008-2009 **Field Geologist**
Hart Crowser, Seattle, WA
Supervisor: Scott Wright
- Conducted field work for geotechnical and environmental projects in and around Seattle, WA, including groundwater and soil sampling, nuclear density testing of soil, and construction monitoring. Prepared field reports and communicated contents with other contractors. Assisted with lab work (grain-size analysis and soil moisture content).*

RESEARCH EXPERIENCE

- 2013-2019 **Local earthquake tomography at Mount St. Helens, WA**

Collaborators: Ken Creager (UW), Seth Moran and Wes Thelen (USGS-CVO), Geoff Abers (Cornell), Alan Levander (Rice), Eric Kiser (Arizona), Brandon Schmandt and Steve Hansen (New Mexico)

Led the deployment and maintenance of a 70-element broadband array at Mount St. Helens, WA (MSH). Compiled travel times from local earthquakes at the array using automatic and manual processing using Antelope seismic software. Performed tomographic inversions of travel-time data to obtain 3-D seismic velocity models of the MSH region, including the first regional S-wave velocity model of this type. Interpreted velocity models to further constrain the geologic and tectonic setting of MSH.

2017-2018 **Seismic travel time interpolation**

Collaborators: Robert Baraldi and Aleksandr Aravkin (UW Applied Math), Rajiv Kumar (Georgia Tech), Ken Creager (UW ESS)

Developed methods to improve seismic travel-time data using spatial smoothing and low-rank interpolation. Has applications for improved seismic tomographic inversions with non-ideal or limited station distribution.

2017 **Imaging Mount St. Helens seismic zone (SHZ) velocity structure and seismicity**

Collaborators: Trenton Cladouhos and Michael Swyer (AltaRock Energy), Kayla Crosbie (Cornell)

Performed local earthquake tomography using data from iMUSH stations and 20 broadband seismometers deployed by AltaRock Energy. Found high V_p/V_s ratios in the top 3 km beneath the SHZ, potentially indicating presence of fluids. Calculated several focal mechanisms for nearby earthquakes, with right-lateral shear consistent with SHZ orientation.

2011-2014 **Source amplitudes of northern Cascadia tectonic tremor**

Collaborators: Ken Creager (UW), Heidi Houston (USC)

Calculated radiated energy rate at the plate interface from tectonic tremor in Cascadia. Interpreted the initiation and propagation phases of episodic tremor and slip events, resulting in a better understanding of stress conditions on the subducting plate interface.

2011-2013 **Envelope Functions at the IRIS Data Management Center (DMC)**

Collaborators: Ken Creager and Justin Sweet (UW), Manoj Bahavar (IRIS DMC)

Created an algorithm to calculate envelope functions of seismic data at different frequency bands to detect and locate tectonic tremor. Worked with the IRIS DMC to provide the envelope functions to the broader seismology community.

2011-2012 **Search for tectonic tremor in Chile after the 2010 Maule earthquake**

Collaborators: Ken Creager (UW), Aaron Wech (USGS)

Using broadband data from the Chile RAMP dataset, applied a tremor location and detection algorithm to search for tectonic tremor and slow slip following the M 8.8 Maule earthquake. Characterized thousands of aftershocks, but no tremor detected.

FIELD AND PRACTICAL EXPERIENCE

2013-2016 Imaging Magma Under Mount St. Helens (iMUSH)

- Assisted in siting locations for 70 broadband seismometers within a 50-km radius of Mount St. Helens, WA. This required coordinating with landowners, State and Federal landholders, and preparing permits;
- Researched and communicated with vendors and prepared purchase orders for batteries and seismic vault equipment totaling more than \$47,000;
- The PIs and I led the installation of the array in 2014 (CMG-3T seismometers with Reftek-130 dataloggers) with 17 volunteers organized into field teams;
- Organized field teams and participated in maintenance of the array from 2014-2016, including reviewing instrument performance metrics, evaluating power needs, and potential site improvements;
- Archived all data for the array at the IRIS Data Management Center; and
- Led the removal of the array in August 2016

2011 (S) Array of Arrays (AofA)

Assisted in removal of dozens of seismic stations on the Olympic peninsula, WA

2006 (S) Cascadia Array For Earthscope (CAFE)

As an IRIS undergraduate research intern, assisted in the siting and deployment of 62 broadband seismometers in western Washington. Using these and other data, wrote senior thesis entitled "Investigation of Cascadia Tremor Correlation with Earth Tides" and presented poster at Fall 2006 AGU meeting

TEACHING EXPERIENCE

- 2018 (F) **Lecturer**, ESS 314: Geophysics (5 credits, 51 students, responsibility: 50%)
2018 (W) **Lecturer**, ESS 202: Earthquakes (5 credits, 49 students, responsibility: 100%)
2016 (F) **Teaching Assistant**, ESS 314: Geophysics (8 labs, 1 lecture)
2016 (S) **Guest Lecturer**, ESS 462: Volcanic Processes (1 lecture)
2015-16 (W) **Grader and Guest Lecturer**, ESS 412/512: Introduction to Seismology (7 lectures)
2013 (F) **Guest Lecturer**, ESS 511: Continuum Mechanics (3 lectures)

MENTORING AND OUTREACH

- 2016-2019 **Primary advisor**, Nancy Sackman, UW undergraduate and graduate student
2015-2016 **Co-advisor**, Luke Fisher, UW undergraduate
2015 **Primary advisor**, Mitchell Williams, IRIS undergraduate research intern
2014 **Primary advisor**, Gina Belair, IRIS undergraduate research intern
2013-2015 **Volunteer**, Pacific Science Center Paws on Science Weekend
Led demonstrations and interactive activities for the local community at "Earthquakes – Shake It Up!" exhibit

MEDIA

- Nov. 2017 Featured in article "[The Next Big Bang](#)," by Steve Olson, *Scientific American*

PUBLICATIONS

Refereed Publications

- Ulberg, C. W.**, Creager, K. C., Houston, H. (2019, *in prep*). Initiation and propagation phases of northern Cascadia episodic tremor and slip events.
- Ulberg, C. W.**, Creager, K. C., Moran, S. C., Abers, G. A., Thelen, W. A., Levander, A., Kiser, E., Schmandt, B., Hansen, S., Crosson, R. S., (2019, *in review*). Local earthquake Vp and Vs tomography in the Mount St. Helens region with the iMUSH broadband array.
- Crosbie, K. J., Abers, G. A., Mann, M. E., Janiszewski, H. A., Creager, K. C., **Ulberg, C. W.**, Moran, S. C., (2019, *in review*). Shear velocity structure from ambient noise and teleseismic surface wave tomography in the Cascades around Mount St. Helens.
- Eakin, C. M., Wirth, E. A., Wallace, A., **Ulberg, C.W.**, Creager, K. C., Abers, G. A., (2019, *submitted*). Subslab mantle entrainment in the Cascadia subduction zone, *Earth and Planetary Science Letters*.
- Mann, M. E., Abers, G. A., Crosbie, K., Creager, K. C., **Ulberg, C. W.**, Moran, S. C., Rondenay, S. (2018, *accepted*). Imaging subduction beneath Mount St. Helens: implications for slab dehydration and magma transport, *Geophysical Research Letters*.
- Baraldi, R., **Ulberg, C. W.**, Kumar, R., Creager, K. C., Aravkin, A. (2018, *under revision*). Relaxation algorithms for matrix completion, with applications to seismic travel-time data interpolation, *Inverse Problems*.
- Kiser, E., Palomeras, I., Levander, A., Zelt, C. A., Harder, S., Schmandt, B., Hansen, S., Creager, K. C., **Ulberg, C. W.** (2016). Magma reservoirs from the upper crust to the Moho inferred from high-resolution Vp and Vs models beneath Mount St. Helens, Washington State, USA, *Geology*, v. 44, no. 6, 411-414.

Published Manuscripts not in refereed journals

- Ulberg, C. W.**, and the iMUSH Team (2017). Imaging magma under Mount St. Helens with geophysical and petrologic Methods, *GeoPRISMS Newsletter*, Issue No. 39, Fall 2017, <http://geoprisms.org/newsletters/imush-science-fall2017/>.
- Ulberg, C. W.**, and members of the iMUSH field team (2015). Report from the field: imaging magma under St. Helens, *GeoPRISMS Newsletter*, Issue No. 34, Spring 2015, <http://geoprisms.org/education-2/report-from-the-field/imush-spring2015/>.
- Ulberg, C. W.**, Creager, K. C., Earth and Space Sciences, University of Washington (2014), Data Services Products: EnvelopeFunctions. <http://ds.iris.edu/ds/products/envelopefunctions/>

Conference abstracts

First author of 14 presentations at national and international meetings, including; AGU Fall meeting (2006, 2012-2017); IRIS workshop (2012, 2014, 2016); GeoPRISMS TEI (Redondo Beach, CA; 2015); Seismix conference (Aviemore, Scotland; 2016); IAVCEI scientific assembly (Portland, OR; 2017); and SSA annual meeting (Seattle, WA; 2019)