

Keith D. Koper
Curriculum Vitae
19 January 2024

Present Position

Keith D. Koper, Ph.D.

Professor in Dept. of Geology & Geophysics

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Education

Ph.D. (Geophysics), Washington University, 1998

B.A. (Math, Geology, ISP), Northwestern University, 1993

Professional Experience

Professor, Dept. of Geology & Geophysics, Univ. of Utah, 2015–present

Director, Univ. of Utah Seismograph Stations, 2010–present

Guest Scientist, Los Alamos National Laboratory, 2016–2021

Assoc. Professor, Dept. of Geology & Geophysics, Univ. of Utah, 2010–2015

Assoc. Professor, Dept. of Earth & Atmos. Sciences, Saint Louis University, 2006–2010

Asst. Professor, Dept. of Earth & Atmos. Sciences, Saint Louis University, 2001–2006

Post-doc, Dept. of Geosciences, University of Arizona, 1998–2001

Academic Recognition

Celebrate U Honoree, Univ. Utah, 2016

Certificate of excellence in reviewing, *Earth Planet. Sci. Lett.*, 2012

Doornbos Prize, IUGG-SEDI, 2006

Citation from Saint Louis University for excellence in research, 2003

Tolman Geoscience Fellowship, Washington University, 1993–1995

Research Interests

array seismology; Earth's ambient seismic noise field; forensic seismology and exotic sources; rupture imaging of giant earthquakes; seismicity and tectonics of the intermountain West; mining induced earthquakes; structure and dynamics of Earth's deep interior—especially the core

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1. Teaching & Mentoring

1.1 Courses taught

Seismology and Nuclear Explosions, EAS-130, SLU – An intro level science course for non-science majors that was designated as a SLU2K course, meaning that enrollment was capped at 19 students, only freshmen could register, and discovery-based learning techniques were emphasized. Taught seven times: fall 2002, fall 2003, fall 2006, fall 2007, fall 2008, fall 2009, and spring 2009.

Introduction to Earthquakes, EAS-193, SLU – An intro level science course designed to fulfill the science requirement of a college-wide core curriculum; enrollment of ~40–50 students. Taught four times: fall 2001, fall 2002, fall 2003, and fall 2005.

Earth Dynamics, EAS-437, SLU – An upper level undergraduate class designated as a required course for geoscience majors; enrollment of ~4–8 students. Taught three times: spring 2005, spring 2006, and spring 2010.

Time Series Analysis, EAS-512, SLU – A graduate course on signal processing with enrollment of ~5–10 students. Taught four times: spring 2003, spring 2005, spring 2007, spring 2009.

Exploration Seismology, EAS-551, SLU – A graduate course on refraction and reflection seismology with enrollment of ~5 students. Taught once in fall 2009.

Geoscience Journal Club, EAS-591, SLU – A seminar course in which grad students present recent scientific papers. Enrollment is typically 10–20 students. Taught three times: spring 2003, fall 2005, fall 2006.

Array Seismology, EAS-593, SLU – A special topics graduate course on array seismology with enrollment of ~5 students. Taught once in fall 2007.

Geophysical Inverse Theory, EAS-610, SLU – A graduate course on inverse theory with enrollment of ~5–10 students. Taught four times: spring 2004, spring 2006, spring 2008, and spring 2010.

Graduate Seminar - Mantle Transition Zone, EAS-619, SLU – A special topics graduate course on the mantle transition zone with enrollment of ~5 students. Taught once in spring 2002.

Signal/Image Processing, GEO5320/6320, Utah - A course on digital signal processing that was cross-listed for advanced undergraduates and graduate students with enrollment of 10–15 students. Taught seven times: spring 2011, spring 2013, fall 2014, spring 2017, fall 2018, spring 2021, fall 2022.

Graduate Seminar - Earth's Inner Core, GEO6920-03, Utah – A special topics graduate course on the inner core with enrollment of 5–10 students. Taught once in fall 2011.

Graduate Seminar – Seismology Topics, GEO6920-17, Utah – A special topics graduate seismology seminar with enrollment of 4–5 students. Taught once in spring 2021.

Graduate Seminar – Seismology Topics, GEO6920-92, Utah – A special topics graduate seismology seminar with enrollment of 4–5 students. Taught once in spring 2023.

Earthquake Seismology and Risk Assessment, GEO-5330/6330, Utah – A course on earthquake seismology that was cross-listed for advanced undergraduates and

graduate students with enrollment of 10–15 students. Taught four times: spring 2012, spring 2014, fall 2015, spring 2018. Revised and renamed to "*Seismic Sources*" and taught in fall 2019 and fall 2021.

1.2 Undergraduate researchers supervised

Riley Murray, 2022–2023, Utah (w/ Baker)
Zachary Claerhout, 2021–2022, Utah (w/ Burlacu)
Avery Conner, 2019–2020, Utah (w/ Burlacu)
Barrett Johnson, 2019–2020, Utah (w/ Burlacu)
Alysha Armstrong, 2018–2020, Utah (w/ Burlacu)
Jonathan Voyles, 2017–2020, Utah (w/ Burlacu)
Nick Forbes, 2018–2019, Utah (w/ Burlacu & Jewell)
Aini Mokhdhari, 2017–2018, Utah (w/ Burlacu)
Arvind Parapuzha, 2016, Utah (w/ Burlacu)
Afiq Mokhtar, 2015–2016, Utah (w/ Burlacu)
Greg Bobetich, 2015–2016, Utah (w/ Burlacu)
Kyler Goddard, 2014–2015, Utah (w/ Burlacu)
Eli Workman, 2013–2014, Utah (w/ Burlacu)
Derrick Chambers, 2013, Utah (w/ Pankow, McCarter)
Yeou Hui Wong, 2012–2013 Utah (w/ Burlacu)
Gavin Thomas, 2012, Utah (w/ Burlacu)
Kevin Seats, 2007–2010, SLU
Boston Fodor, 2005–2007, SLU
Marina Dombrovskaya, 2003–2005, SLU
Veronica Parker, 2002–2005, SLU
Teresa Herrmann, 2002, SLU
Jill Franks, 2001–2003, SLU
Maira Pyle, 2001–2002, SLU
Alisa Miller, 2000–2001, Arizona

1.3 Graduate students supervised

Hutchings, Sean, M.S. 2023; Ph.D. 2024–present, Utah
Armstrong, Alysha, Ph.D., 2020–present, Utah
Forbes, Nick, M.S., 2023, Utah
Holt, Monique, Ph.D., 2021, Utah
Guanning Pang, Ph.D., 2021, Utah
Chase Batchelor, M.S., 2016, Utah (co-advised with Pankow)
Derrick Chambers, M.S., 2015, Utah (co-advised with McCarter, Pankow)
Oner Sufri, M.S., 2009, SLU; Ph.D. 2015, Utah
Tex Kubacki, M.S., 2014, Utah (co-advised with Pankow, McCarter)
Christine Gammans, M.S., 2013, Utah (co-advised with Pankow, Pechmann)
Kevin Kwong, M.S., 2013, Utah
Kim Dyal, M.S.S.S.T, 2012, Utah
Veronica Parker, M.S., 2010, SLU
Yan Xu, Ph.D., 2009, SLU
Zuihong (Kathy) Zou, Ph.D., 2007, SLU

Felipe Leyton, Ph.D., 2006, SLU

1.4 Post-doctoral researchers supervised

James Holt, 2019–2021, Utah

Jamie Farrell, 2014–2015, Utah

Moira Pyle, 2009–2012, SLU/Utah

Ali Fatehi, 2006–2008, SLU

Raef Abd-Elmoneam Elsayed, 2002–2003, SLU

1.5 Visiting Students Mentored

Holt, James, Ph.D. student from Univ. Liverpool, 2018–2019 (w/ Pechmann)

Zongshan Li, undergraduate student from USTC, summer of 2017

Wenyang Li, undergraduate student from USTC, summer of 2016

Qiaoxia Liu, Ph.D. student from USTC, all of 2015

2. Research

2.1 Invited Academic Talks

“*Forensic Seismology in the Intermountain West of the U.S.*”, Sandia National Laboratory, July 28, 2022

“*Forensic Seismology in the Intermountain West of the U.S.*”, Stanford University, June 2, 2022

“*New observations and Interpretations of the Fine-Scale Structure of Earth's Solid Inner Core*”, University of Utah, March 3, 2022

“*Geophysical Characterization of a Small-area Collapse in the Trona Mining District of SWyoming During February 2019*”, USGS NEIC virtual seismology seminar, November 19, 2020.

“*Analysis of the March 2020 Magna, Utah, Earthquake Sequence: Evidence for a Listric Wasatch fault*”, University of Oregon virtual geophysics seminar, October 23, 2020.

“*Forensic Seismology in the Western U.S.*”, Colorado School of Mines, Golden, CO, October 10, 2019

“*Using CTBTO International Monitoring System (IMS) Seismic Arrays for Basic Science*”, invited keynote, European Seismological Commission Meeting, Malta, Sept. 4, 2018.

“*Imaging Earth's Inner Core with Seismic Arrays*”, Southern Methodist University, Dallas, TX, April 26, 2018.

“*Mining Induced Earthquakes in Utah*”, Southern Methodist University, March 24, 2017.

“ *M_L - M_C : A Possible Depth Discriminant for Small Seismic Events Recorded at Local Distances*”, Los Alamos National Laboratory, Sept. 15, 2016.

“*Fine-Scale Heterogeneity in Earth's Inner Core*”, Earth Life Science Institute, Tokyo Tech, Tokyo, Japan, Feb. 10, 2016.

“*Earthquake Early Warning in the Intermountain West*”, Basin and Range Province Seismic Hazards Summit III, Salt Lake City, UT, Jan. 13, 2015.

“*Source Physics - An Academic Perspective*”, 2014 Review of Monitoring Research, Albuquerque, NM, June 19, 2014.

“*Seismic Network Monitoring at Yellowstone*”, Yellowstone Volcano Observatory

consortium meeting, Mammoth Springs, MT, May 7, 2014.
"Using Seismology to Observe Ocean Storms and Storminess", NAS Workshop on
 Observations of Sea-Level Rise and Storminess in California, Irvine, CA, June 20,
 2013.
"Rupture Imaging of Recent Giant Earthquakes", Northwestern University, Jan. 11, 2013.
"Observations of Earth's Background Seismic Radiation", New Mexico Tech, Sept. 22,
 2011.
"Initial Rupture Models for the Mw 9.0 Tohoku Earthquake of 11 March 2011", Utah
 Geological Association, May 9, 2011, Salt Lake City.
*"The M6.3 New Zealand Earthquake of Feb. 21, 2011 & M9.0 Japan Earthquake of
 March 11, 2011"*, Utah Seismic Safety Commission, April 28, 2011, Salt Lake City.
"Using Arrays to Characterize and Locate Sources of Short-Period Seismic Noise",
 European Geophysical Union General Assembly, April 2011, Vienna.
 University of Utah, October, 2009
 Southern Methodist University, February, 2009
 USGS - National Earthquake Information Center, December, 2008
 University of Chicago, May, 2008
 Georgia Tech. University (two talks), March, 2008
 Washington University, October, 2007
 USGS - National Earthquake Information Center, August, 2007
 University of Minnesota, May, 2007
 Saint Louis University, November, 2006
 10th SEDI Meeting, Prague, Czech Republic, July, 2006
 University of Illinois, November, 2005
 Carnegie Institution of Washington, October, 2005
 University of Kentucky, April, 2005
 Princeton University, March, 2005
 University of Missouri, Columbia, May, 2003
 Northwestern University, Spring 2002
 Lawrence Livermore National Laboratory, Summer 2002
 Washington University, Fall, 2001
 Saint Louis University, Spring, 2001
 University of Florida, Spring, 2001
 Rice University, Spring, 2001
 Purdue University, Winter, 2000
 University of Hawaii, Winter, 2000
 University of Wyoming, Winter, 2000
 Lawrence Livermore National Laboratory, Fall 1999

2.2 External funding

23. Feature Augmented Prediction of Seismic Depth for Event Screening, Air Force
 Research Laboratory, May 8, 2022 – July 8, 2024, subcontract #2 to Univ. Utah via
 ARA, \$193,617 (Keith D. Koper, PI)
22. Machine Intelligence Solutions for Nuclear Explosion Monitoring, Air Force
 Research Laboratory, November 1, 2020 – September 30, 2021, subcontract #1 to

- Univ. Utah via ARA, \$43,200 (Keith D. Koper, PI; Kristine Pankow, co-PI)
21. Operation and Maintenance of the Yellowstone Regional Seismic Network and Earthquake Information System, United States Geological Survey, G21AC10068, Feb. 1, 2021 – Jan. 31, 2026, \$2,042,840, estimated (Keith D. Koper, PI; Jamie Farrell, co-PI)
 20. Relative Contributions to Long Duration Signals from Shallow Seismic Events, Air Force Research Laboratory, July 1, 2020 – June 30, 2023, \$369,971 (Keith D. Koper, PI)
 19. Regional and Urban Seismic Monitoring: Wasatch Front, Utah, and Neighboring Intermountain West, United States Geological Survey, USGS-G20AP00036, Feb. 1, 2020 – Jan. 31, 2025, \$4,056,000, estimated (Keith D. Koper, PI; Kristine Pankow, co-PI)
 18. Regional and Urban Seismic Monitoring: Wasatch Front, Utah, and Neighboring Intermountain West, United States Geological Survey, USGS-G15AC00028 Supplemental Award, Sept. 1, 2019 – Jan. 31, 2020, \$157,000, (Keith D. Koper, PI; Kristine Pankow, co-PI)
 17. Regional and Urban Seismic Monitoring: Wasatch Front, Utah, and Neighboring Intermountain West, United States Geological Survey, USGS-G15AC00028 Supplemental Award, Oct. 1, 2018 – Sept. 30, 2019, \$170,000, (Keith D. Koper, PI; Kristine Pankow, co-PI)
 16. Collaborative Research: The origin and propagation of shallow water microseisms: a multidisciplinary study at Yellowstone Lake, National Science Foundation, NSF-1760094, April 1, 2018 – March 30, 2020, \$176,563 to Utah (Jamie Farrell, Utah PI; Keith D. Koper, Utah co-PI; Robert Sohn, WHOI PI)
 15. Geophysical Monitoring and Characterization of the Utah Region, Dept. of Energy, Sandia National Laboratory, January 1, 2019 – December 30, 2020, \$229,000 (Keith D. Koper, PI; Kristine Pankow, co-PI)
 14. Mapping Fine-Scale Structure in Earth's Inner Core with a Global Arrays of Seismic Arrays, National Science Foundation, EAR-1722542, July 1, 2017 – June 30, 2020, \$270,000 (Keith D. Koper, PI)
 13. Evaluation of M_L - M_C as a Possible Depth Discriminant at Local Distances, Air Force Research Laboratory, FA9453-17-C-0022, June 1, 2017 – May 30, 2020, \$324,931 (Keith D. Koper, PI)
 12. MIS Analysis and DINSAR Measurements – Tools for Improving Mine Ground Control Safety, National Institute for Occupational Safety and Health, 200-2016-90240, Sept. 1, 2016 – Oct. 31, 2021, \$1,225,764, (Michael K. McCarter, PI; Jessica Wempen, co-PI; Keith D. Koper co-PI).
 11. Operation and Maintenance of the Yellowstone Regional Seismic Network and Earthquake Information System, United States Geological Survey, USGS-G16AC00029, Feb. 1, 2016 – Jan. 31, 2019, \$914,205, (Keith D. Koper, PI; Jamie Farrell, co-PI)
 10. Regional and Urban Seismic Monitoring: Wasatch Front, Utah, and Neighboring

- Intermountain West, United States Geological Survey, USGS-G15AC00028, Feb. 1, 2015 – Jan. 31, 2020, \$3,962,400, (Keith D. Koper, PI; Kristine Pankow, co-PI)
9. Operation and Maintenance of the Yellowstone Regional Seismic Network and Earthquake Information System, United States Geological Survey, USGS-G13AC00018, Feb. 1, 2013 – Jan. 31, 2016, \$804,037, (Keith D. Koper, PI)
 8. Regional and Urban Seismic Monitoring: Wasatch Front, Utah, and Neighboring Intermountain West, United States Geological Survey, USGS-G10AC0085, 2010 – 2015, \$3,153,149, (Keith D. Koper, PI; Kristine Pankow, co-PI)
 7. Upgrades to Earthquake Monitoring Systems in the Utah Region, United States Geological Survey, USGS-G09AC00467, \$458,025, (Kristine Pankow, PI; Keith D. Koper, co-PI)
 6. Location and Characterization of Ambient Seismic Noise Using USArray, National Science Foundation, EAR-0951558, 2010–2013, \$243,656, (Keith D. Koper, PI)
 5. Seismic Imaging of the Inner Core Boundary region, National Science Foundation, EAR-0537438, 2006–2010, \$193,871, (Keith D. Koper, PI)
 4. Modeling P Wave Multipathing at Regional Distances ($13^\circ - 30^\circ$) in Southeast Asia, Air Force Research Laboratory, FA8718-06-C-0003, 2005–2007, \$149,301 (Keith D. Koper, PI)
 3. Mapping the Fine Structure of Earth’s Inner Core with Seismic Array Data, National Science Foundation, EAR-0229103, 2003–2006, \$147,937 (Keith D. Koper, PI)
 2. Upgrade of Computer Facilities for the Seismology Research Group at Saint Louis University, National Science Foundation, EAR-0214259, 2002–2005, \$67,425, Keith D. Koper (PI), Lupei Zhu (co-PI), Robert B. Herrmann (co-PI), Brian J. Mitchell (co-PI), Timothy M. Kusky (co-PI)
 1. Analysis of Steep Angle Seismic Reflections from Earth’s Inner and Outer Core, National Science Foundation, EAR0087330, 2000–2003, \$80,196 (Keith D. Koper, PI)

2.3 Peer reviewed journal publications

(† indicates student or post-doc mentored by Dr. Koper)

103. Wang, W., J. E. Vidale, G. Pang, K. D. Koper, and R. Wang (2024). Inner core backtracking by seismic waveform change reversals, *Nature*, in review.
102. Koper, K. D., R. Burlacu, R. Murray[†], B. Baker, R. Tibi, and A. Mueen (2024). Inferring the focal depths of small earthquakes in southern California using physics-based waveform features, *Bull. Seism. Soc. Am.*, in review.

—2023 Peer-Reviewed Journal Publications—

101. [†]Armstrong, A., Z. [†]Claerhout, B. Baker, and K. D. Koper (2023). A deep learning phase picker with calibrated Bayesian-derived uncertainties for earthquakes in the Yellowstone volcanic region, *Bull. Seism. Soc. Am.*, *113*, 2323–2344.
100. [†]Pang, G., K. D. Koper, S.-M. [†]Wu, W. Wang, M. Lasbleis, and G. Euler (2023). Enhanced inner core fine-scale heterogeneity toward the Earth’s center, *Nature*, *620*,

570–575.

99. Farrell, J., K. D. Koper, and R., Sohn (2023). The relationship between wind, waves, bathymetry, and microseisms in Yellowstone Lake, Yellowstone National Park, *J. Geophys. Res.*, *123*, e2022JB025943.

—2022 Peer-Reviewed Journal Publications—

98. Dzubay, A., J. R. Moore, R. Finnegan, E. K. Jensen, P. R. Geimer, and K. D. Koper (2022). Rotational components of normal modes measured at a natural sandstone tower (Kane Springs Canyon, Utah, U.S.A.), *Seismic Record*, *2*, 260–268.
97. †Wu, S.-M., G. †Pang, and K. D. Koper (2022). A search for large-scale variations in the fine-scale structure of Earth's inner core, *J. Geophys. Res.*, *127*, e2022JB024420.
96. Kong, Q., R. Wang, W. R. Walter, M. Pyle, K. Koper, and B. Schmandt (2022). Combining deep learning with physics based features in explosion-earthquake discrimination, *Geophys. Res. Lett.*, *49*, e2022GL098645, doi:10.1029/2022GL098645.
95. †Pang, G., and K. D. Koper (2022). Excitation of Earth's inner core rotational oscillation during 2001–2003 captured by earthquake doublets, *Earth Planet. Sci. Lett.*, *584*, 117504, doi:10.1016/j.epsl.2022.117504.
94. †Holt, J., J. C. Pechmann, and K. D. Koper (2022). Recalibration of the local magnitude (M_L) scale for earthquakes in the Yellowstone volcanic region, *Bull. Seism. Soc. Am.*, *112*, 905–920, doi:10.1785/0120210240.

—2021 Peer-Reviewed Journal Publications—

93. Wang, R., B. Schmandt, M. †Holt, and K. D. Koper (2021). Advancing local distance discrimination of explosions and earthquakes with joint P/S and M_L - M_C classification, *Geophys. Res. Lett.*, e2021GL09572148, doi:10.1029/2021GL095721.
92. Li, J., M. Chen, K. D. Koper, T. Zhou, S. Li, G. Li (2021). FastTrip: A fast MPI-accelerated 1D triplication waveform inversion package for constraining mantle transition zone discontinuities, *Seism. Res. Lett.*, *92*, 2647–2656, doi:10.1785/0220200475.
91. Gold, R. D., J. Bormann, and K. D. Koper (2021). Preface to the focus section of the 2020 Intermountain West earthquakes, *Seism. Res. Lett.*, *92*, 636–639, doi:10.1785/0220210001.
90. Tibi, R., P. Hammond, R. Brogan, C. J. Young, and K. D. Koper (2021). Deep learning denoising applied to regional distance seismic data in Utah, *Bull. Seism. Soc. Am.*, *111*, 775–790, doi:10.1785/0120200292.
89. †Holt, J., K. M. Whidden, K. D. Koper, K. L. Pankow, K. Mayeda, J. C. Pechmann, B. Edwards, R. Gök, and W. R. Walter (2021). Towards robust and routine determination of M_w for small earthquakes: Application to the 2020 M_w 5.7 Magna, Utah, seismic sequence, *Seism. Res. Lett.*, *92*, 725–740, doi:10.1785/0220200320.

88. Baker, B., M. M. †Holt, K. L. Pankow, K. D. Koper, and J. Farrell (2021). Monitoring the 2020 Magna, Utah, earthquake sequence with nodal seismometers and machine learning, *Seism. Res. Lett.*, *92*, 787–801, doi:10.1785/0220200316.
87. Pankow, K. L., J. Rusho, J. C. Pechmann, J. M. Hale, K. Whidden, R. Sumsion, J. †Holt, M. Mesimeri, D. Wells, and K. D. Koper (2021). Responding to the 2020 Salt Lake Valley, Utah, earthquake sequence during the COVID-19 pandemic shutdown, *Seism. Res. Lett.*, *92*, 6–16, doi:10.1785/0220200265.
86. Koper, K. D., M. M. †Holt, J. R. †Voyles, R. Burlacu, M. L. Pyle, R. Wang, and B. Schmandt (2021). Discrimination of small earthquakes and buried single-fired chemical explosions at local distances (<150 km) in the Western U. S. from comparison of local magnitude (M_L) and coda duration magnitude (M_C), *Bull. Seism. Soc. Am.*, *111*, 558–570, doi:10.1785/0120200188.
85. Johnson, S. A., D. J. A. Chambers, M. S. Boltz, and K. D. Koper (2021). Application of a convolutional neural network for seismic phase picking of mining-induced seismicity, *Geophys. J. Inter.*, *224*, 230–240, doi:10.1093/gji/ggaa449.
- 2020 Peer-Reviewed Journal Publications—
84. †Pang, G., K. D. Koper, M. Mesimeri, K. L. Pankow, B. Baker, J. Farrell, J. †Holt, P. Roberson, R. Burlacu, J. C. Pechmann, K. Whidden, M. M. †Holt, A. Allam, and C. DuRoss (2020), Evidence for a listric Wasatch fault from the 2020 Magna, Utah, earthquake sequence, *Geophys. Res. Lett.*, *47*, e2020GL089798, doi:10.1029/2020GL089798.
83. Anthony, R. E., A. T. Ringler, D. C. Wilson, M. Bahavar, and K. D. Koper (2020), How processing methodologies can distort and bias power spectral density estimates of seismic background noise, *Seism. Res. Lett.*, *91*, 1694–1706, doi:10.1785/0220190212.
82. Xu, Y., Koper, K. D., Burlacu, R., Herrmann, R. B., and Li, D.-N. (2020), A new uniform moment tensor catalog for Yunnan, China, from January 2000 through December 2014, *Seism. Res. Lett.*, *91*, 891–900, doi:10.1785/0220190242.
81. Pankow, K. L., Stickney, M., Ben-Horin, J. Y., Litherland, M., Payne, S., Koper, K. D., Bilek, S. L., and Bogolub, K. (2020), Regional seismic network monitoring in the Eastern Intermountain West, *Seism. Res. Lett.*, *91*, 631–646, doi:10.1785/0220190209.
80. Koper, K. D. (2020), The importance of regional seismic networks in monitoring nuclear test-ban treaties, *Seism. Res. Lett.*, *91*, 573–580, doi:10.1785/0220190160.
79. Wu, S.-M., F.-C. Lin, J. Farrell, B. Shiro, L. Karlstrom, P. Okubo, and K. D. Koper (2020), Spatiotemporal seismic structure variations associated with the 2018 Kilauea eruption based on temporary dense geophone arrays, *Geophys. Res. Lett.*, *47*, doi:10.1029/2019GL086668.
78. †Voyles, J., M. M. †Holt, J. M. Hale, K. D. Koper, R. Burlacu, and D. J. A. Chambers (2020), A new catalog of explosion source parameters in the Utah region with

application to M_L - M_C based depth discrimination at local distances, *Seism. Res. Lett.*, *91*, 222–236, doi:10.1785/0220190185.

—2019 Peer-Reviewed Journal Publications—

77. †Holt, M. M., K. D. Koper, W. Yeck, S. D’Amico, Z. Li, J. M. Hale, and R. Burlacu (2019), On the portability of M_L - M_C as a depth discriminant for small seismic events recorded at local distances, *Bull. Seismol. Soc. Am.*, *109*, 1661–1673.
76. Ye, L., T. Lay, H. Kanamori, and K. D. Koper (2019), Reply to: Comment by Rodrigo Cienfuegos on “Rapidly Estimated Seismic Source Parameters for the 16 September 2015 Illapel, Chile, M_w 8.3 Earthquakes” by Lingling Ye, Thorne Lay, Hiroo Kanamori, and Keith D. Koper, *Pure Appl. Geophys.*, *176*, 2753, doi:10.1007/s00024-019-02214-3.
75. †Pang, G., K. D. Koper, J. M. Hale, R. Burlacu, J. Farrell, and R. B. Smith (2019), The 2017–2018 Maple Creek earthquake sequence in Yellowstone National Park, USA, *Geophys. Res. Lett.*, *46*, 4653–4663, doi:10.1029/2019GL082376.

—2018 Peer-Reviewed Journal Publications—

74. Attanayake, J., C. Thomas, V. F. Cormier, M. S. Miller, and K. Koper (2018), Irregular transition layer beneath the Earth’s inner core boundary from observations of antipodal PKIKP and PKIIKP waves, *Geochem. Geophys. Geosyst.*, *19*, 3607–3622, doi:10.1029/2018GC007562.
73. Tibi, R., K. D. Koper, K. L. Pankow, and C. J. Young (2018), Discrimination of anthropogenic events and tectonic earthquakes in Utah using a quadratic function approach with local-distance amplitude ratios, *Bull. Seism. Soc. Am.*, *108*, 2788–2800. doi:10.1785/0120180024.
72. Koper, K. D., K. L. Pankow, J. C. Pechmann, J. M. Hale, R. Burlacu, W. L. Yeck, H. M. Benz, R. B. Herrmann, D. T. Trugman, and P. M. Shearer (2018), Afterslip enhanced aftershock activity during the 2017 earthquake sequence near Sulphur Peak, Idaho, *Geophys. Res. Lett.*, *45*, 5352–5361, doi:10.1029/2018GL078196.
71. †Pang, G., K. D. Koper, M. C. Stickney, J. C. Pechmann, R. Burlacu, K. L. Pankow, S. Payne, and H. M. Benz (2018), Seismicity in the Challis, Idaho region, January 2014 – May 2017: Late aftershocks of the 1983 M_s 7.3 Borah Peak earthquake, *Seism. Res. Lett.*, *89*, 1366–1378, doi:10.1785/0220180058.
70. Tibi, R., K. D. Koper, K. L. Pankow, and C. J. Young (2018), Depth discrimination using R_g -to- S_g spectral amplitude ratios for seismic events in Utah recorded at local distances, *Bull. Seism. Soc. Am.*, *108*, 1355–1368, doi:10.1785/0120170257.

—2017 Peer-Reviewed Journal Publications—

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20. Burlacu, R., P. M. Roberson, J. M. Hale, C. Gray, H. Willis, K. D. Koper, J. C. Pechmann, and K. L. Pankow (2011), Earthquake Activity in the Utah Region Preliminary Epicenters January 1 - March 31, 2011, quarterly report of Univ. Utah Seismograph Stations, pp. 1-32.
19. Burlacu, R., P. M. Roberson, J. M. Hale, C. Gray, H. Willis, K. D. Koper, J. C. Pechmann, and K. L. Pankow (2011), Earthquake Activity in the Utah Region Preliminary Epicenters October 1 - December 31, 2010, quarterly report of Univ. Utah Seismograph Stations, pp. 1-34.

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18. Koper, K. D. (2010), Geophysics, in Encyclopedia Britannica 2010 Book of the Year, Encyclopedia Britannica, Inc., pp. 229-230.
17. Burlacu, R., P. M. Roberson, J. M. Hale, W. Pomerleau, K. D. Koper, J. C. Pechmann, and K. L. Pankow (2010), Earthquake Activity in the Utah Region Preliminary Epicenters July 1 - September 30 2010, quarterly report of Univ. Utah Seismograph Stations, pp. 1-33.

—2009 Other Scientific Publications—

16. Koper, K. D. (2009), Geophysics, in Encyclopedia Britannica 2009 Book of the Year, Encyclopedia Britannica, Inc., pp. 226-227.

—2008 Other Scientific Publications—

15. Koper, K. D. (2008), Geophysics, in Encyclopedia Britannica 2008 Book of the Year, Encyclopedia Britannica, Inc., pp. 228-229.
14. Koper, K. D. and A. Fatehi (2008), Modeling P Wave Multipathing at Regional Distances in Southeast Asia, Final Technical Report FA8718-06-C-0003, Air Force Research Lab, pp. 1-82.

—2007 Other Scientific Publications—

13. Koper, K. D. (2007), Geophysics, in Encyclopedia Britannica 2007 Book of the Year, Encyclopedia Britannica, Inc., pp. 199-200.
12. Fatehi, A., and K. D. Koper (2007), Modeling P Wave Multipathing in Southeast Asia, in Proceedings of the 29th Monitoring Research Review, Denver, CO, pp. 1-11.

—2006 Other Scientific Publications—

11. †Fatehi, A., and K. D. Koper (2006), Characterization of P Wave Propagation and Multipathing in the Upper Mantle Beneath South Asia, Proceedings of the 28th Seismic Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, pp. 8-14.
10. Flanagan, M. P., S. C. Myers, and K. D. Koper (2006), Regional Travel- Time Uncertainty and Seismic Location Improvement using a Three-Dimensional a priori Velocity Model, Proceedings of the 28th Seismic Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, pp. 407-416.
9. Koper, K. D. (2006), Geophysics, in Encyclopedia Britannica 2006 Book of the Year, Encyclopedia Britannica, Inc., pp. 168-169.

—2005 Other Scientific Publications—

8. Koper, K. D. (2005), Geophysics, in Encyclopedia Britannica 2005 Book of the Year, Encyclopedia Britannica, Inc., pp. 169-170.

—2004 Other Scientific Publications—

7. Koper, K. D. (2004), Seismic Analysis of the Toulouse Disaster of September 21, 2001, expert report prepared for Total.

—2002 Other Scientific Publications—

6. Koper, K. D. (2002), Seismic Observations of the 19 August 2000 Pipeline Explosion Near Carlsbad, New Mexico, expert witness report prepared for law firm of Spence, Moriarty, and Schuster.

—2000 Other Scientific Publications—

5. Reinke, R. E., J. A. Leverette, K. D. Koper, and T. C. Wallace (2000), Divine Buffalo 7 Seismic, Acoustic, and Electric Measurements, DB07 technical report for DTRA.

4. Koper, K. D., and T. C. Wallace (2000), Propagation characteristics of regional seismic phases in and around Siberia, Technical Report for Defense Threat Reduction Agency under contract DSWA01-97-C-0123.

—1999 Other Scientific Publications—

3. Wiens, D. A., K. D. Koper, J. J. McGuire, and N. Snider (1999), Seismological Constraints on Slab Structure and the Mechanism of Deep Earthquakes, in Mysen, B., D. Ulmer, P. and Walter, M., conveners, Processes and Consequences of Deep Subduction, *Terra Nostra*, 99, pp 115–117, Alfred-Wegener-Stiftung, Bonn, Germany.
2. Koper, K. D., and T. C. Wallace (1999), Regional Wave Propagation in Siberia, in Proceedings of 21st Annual Symposium on Monitoring a Comprehensive Test Ban Treaty (CTBT), Las Vegas, Nevada.

—1998 Other Scientific Publications—

1. Koper, K. D. (1998), Computational Approaches to Seismology, Ph.D. thesis, Washington University, St. Louis, MO.

2.5 Google Scholar profile

My Google Scholar profile can be accessed at:

<http://scholar.google.com/citations?user=YqHslWQAAAAJ&hl=en>

It provides a freely available measure of scientific impact by automatically tracking citations and keeping a running calculation of the h-index and i10-index.

3. Service

3.1. Professional service

Editor-in-Chief, *The Seismic Record*, 2020–present

Member of U.S. Air Force Seismic Review Panel, 2011–present

Vice-Chair & Chair of Utah Seismic Safety Commission, 2010–2023

Member of DOE external review panel on Signal Analysis for SNL, 2022

Member of Seismological Society of America subcommittee to update the joint SSA-AGU statement on the Comprehensive Nuclear Test Ban Treaty, 2022

Member of AGU Aki Award Subcommittee, 2019–2020

Member of *Eos* editorial/scientific advisory board, 2010–2021

Guest Editor, *Seismological Research Letters* special focus section on 2020

Intermountain West earthquakes, 2020–2021

Member/Chair of SSA Richter Award Subcommittee, 2018–2020

Member of Advisory Committee on Earthquake Hazard Reduction, 2019

Member of AGI Critical Needs Working Group, 2019–2020

Member of external review panel for Dept. of Earth Sciences and Center for Earthquake Information at Univ. of Memphis, 2019

Member of DOE external review panels on Signal Analysis for LANL, LLNL, and SNL, 2019

Member of IRIS board of directors, 2016–2018
 "Forensic Seismology for Situational Awareness: Seismic Monitoring Beyond Earthquakes", invited briefing to U.S. Senate staffers, Washington D.C., June 19, 2018

Member of Seismological Society of America subcommittee to update the joint SSA-AGU statement on the Comprehensive Nuclear Test Ban Treaty, 2017

Member of DOE external review panels on Signal Analysis for LANL, LLNL, and SNL, 2016

Member of NSF Geophysics SCEC5 external review panel, 2016

Member of LLNL external review committee for energy and climate, 2015

Member of NSF IRIS/GSN external review panel, 2015

Co-convener of fall AGU session on microseisms, San Francisco, CA, 2014

Co-convener IRIS special interest group on global arrays, Sunriver, OR, 2014

Co-organizer of IASPEI session on array seismology, Gothenburg, Sweden, 2013

Co-organizer of IRIS workshop on array seismology, Rayleigh, NC, 2013

Co-chair of organizing committee for 2013 Annual meeting of Seismological Society of America, 2012–2013

Chair of the Incorporated Research Institutions for Seismology (IRIS) Data Management System Standing Committee (DMSSC), 2008–2011; member of DMSSC 2004–2007, 2012

Chair of Incorporated Research Institutions for Seismology (IRIS) Data Products Working Group (DPWG), 2009–2012

Associate Editor for Bulletin of the Seismological Society of America, 2003–2010

Member of Seismological Society of America (SSA) and American Geophysical Union (AGU)

Peer review of proposals submitted to: The National Science Foundation programs of Geophysics, CSEDI, Earthscope, Instrumentation and Facilities; Incorporated Research Institutions for Seismology; the National Nuclear Security Administration; the United States Geological Survey NEHRP; program; the Australian Research Council. About 5–10 reviews per year.

Peer review of manuscripts submitted to: Bulletin of the Seismological Society of America; Earth and Planetary Science Letters; Earth, Planets, Space; EOS Trans. AGU; Geophysical Journal International; Geophysical Research Letters; International Journal of Coal Geology; Journal of Earth Science; Journal of Geophysical Research; Journal of Seismology; Nature; Nature Communications; Physics of the Earth and Planetary Interiors; Progress in Earth and Planetary Science; Pure and Applied Geophysics; Science; Seismological Research Letters; Soils and Foundations. About 10–12 reviews per year.

3.2 University, college, and departmental service

Member of college executive/advisory committee (Utah), 2016–2023

Member of departmental undergraduate affairs committee, 2022

Member of departmental awards committee, 2022

Chair of departmental awards committee (Utah), 2020

Member of departmental merit review committee (Utah), 2020

Member of ad-hoc faculty RPT committee (Utah), 2020

Member of college RPT committee (Utah), 2016, 2020
 Member of University of Utah Faculty Senate, 2019–2022
 Member of Univ. Utah Senate Personnel & Elections Committee, 2019–2022
 Chair of departmental merit review committee (Utah), 2019
 Member of departmental undergraduate affairs committee (Utah), 2019
 Member of departmental merit review committee (Utah), 2016
 Member of departmental lecture series committee (Utah), 2015–2016
 Member of departmental strategic planning committee (Utah), 2014–2015
 Member of geophysics special funds committee (Utah), 2014–2016
 Member of departmental space committee (Utah), 2013–2014
 Member of departmental graduate affairs committee (Utah), 2011–2014
 Chair of departmental ad-hoc RPT sub-committee (Utah), 2013, 2015, 2017
 Chair of search committee for tectonophysicist (Utah), 2011
 Member of search committee for exploration seismologist (Utah), 2010–2011
 Member of ad-hoc faculty RPT committee (Utah), 2010, 2015
 Director of geoscience graduate programs (SLU), 2007–2009
 Member of university research committee (SLU), 2002–2006
 Departmental rep. for geoscience E&O (SLU), 2001–2005
 Member of search committee for departmental chair (SLU), 2003–2004
 Member of search committee for geology faculty member (SLU), 2004
 Member of Ph.D. thesis committee (Beshara Sholy, 2002, SLU; Mohammed Fnais, 2004, SLU; Hongyi Li, 2005, SLU; Ali Fatehi, 2006, SLU; Sara Pozgay, 2007, WashU; Risheng Chu, 2008, SLU; Hongfeng Yang, 2010, SLU; Sebastiano d'Amico, 2010, SLU; Hongzhu Cai, 2015, Utah; Yao Yao, 2016, Utah; Lisa Linville 2017, Utah; Wei Lin, 2018, Utah; Michael Jorgensen, 2019, Utah; Feng Lin, 2020, Utah; Sin-Mei, 2020, Utah; Paul Geimer, 2021, Utah; Riley Finnegan, 2023; Erin Jensen, 2023; Daniel Wells, 2023)
 Member of M.S. thesis committee (Rachel Huson, 2002, SLU; Julia Kurpan, 2007, SLU; Kevin Jensen, 2013, Utah; Mark Hale, 2013, Utah; Yao Yao, 2013, Utah; Lisa Linville, 2014, Utah; Stefanie Whittaker, 2014, Utah; Alison Starr, 2015, Utah; Jared Stein, 2015, Utah; Steven Potter, Utah, 2017; Andy Trow, Utah, 2018; Dallan Coons, Utah, 2018; Amy Record, Utah, 2020)
 Member of M.S.S.T committee (Mindy Timothy, 2014; Kristel Hansen, 2014)

4. Administration

I have been director of the University of Utah Seismograph Stations (UUSS) since July 2010. UUSS is a distinct organizational unit within the Department of Geology and Geophysics that focuses on research, education, and public service related to earthquakes and seismic monitoring. We have ~21 full time equivalent employees, and an annual budget of approximately \$3,000,000. I am responsible for overall leadership, management, and stewardship of UUSS. Electronic versions of UUSS annual reports for 2012–2021 are available from the UUSS web page (<https://quake.utah.edu/tag/annual>).

5. Acronyms

AGU – American Geophysical Union

AFRL – Air Force Research Laboratory
CSEDI – Cooperative Studies of Earth's Deep Interior (an NSF program)
CTBTO – Comprehensive Nuclear Test Ban Treaty Organization
DINSAR – Differential Interferometric Synthetic Aperture Radar
DMS – Data Management System (a component of IRIS)
DPWG – Data Products Working Group (a component of IRIS)
DOE – U.S. Department of Energy
EAS – Department of Earth & Atmospheric Sciences at SLU
GSN – Global Seismic Network
E&O – Education and outreach
EOS – EOS Transactions of the AGU (a weekly newsletter)
IASPEI – International Association of Seismology and Physics of the Earth's Interior
IRIS – Incorporated Research Institutions for Seismology
ISP – Integrated Science Program (an explicit major at Northwestern Univ.)
IUGG – International Union of Geodesy and Geophysics
LANL – Los Alamos National Laboratory
LLNL – Lawrence Livermore National Laboratory
MIS – Mining induced seismicity
M.S.S.S.T. – Masters of Secondary School Science Teaching (a UU degree program)
NAS – National Academy of Sciences
NEHRP – National Earthquake Hazard Reduction Program
NSF – National Science Foundation
PI – Principal Investigator
RPT – Rank, promotion, and tenure
SCEC – Southern California Earthquake Center
SEDI – Study of Earth's Deep Interior
SLU – Saint Louis University
SME – The Society for Mining, Metallurgy & Exploration
SNL – Sandia National Laboratory
SSA – Seismological Society of America
UU – University of Utah
UUS – University of Utah Seismograph Stations
USGS – United States Geological Survey
USTC – University of Science & Technology, Hefei, China
WHOI – Woods Hole Oceanographic Institution