MATTHEW W. HERMAN

Assistant Professor
Department of Geological Sciences
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Professional Appointments

California State University, Bakersfield, Bakersfield, CA
Assistant Professor — Aug 2020–Present

Utrecht University, Utrecht, The Netherlands
Postdoctoral Researcher, Tectonophysics Research Group (Supervisor: Rob Govers) — 2017–2020

The Pennsylvania State University, University Park, PA
NASA Ph.D. Fellow, Department of Geosciences — 2015–2017
Teaching Assistant, Department of Geosciences — 2010–2015

Education

The Pennsylvania State University
Ph.D. Geosciences (Advisor: Kevin Furlong) — 2017
Dissertation: *Deformation Processes Throughout the Earthquake Cycle*

M.S. Geosciences (Advisor: Kevin Furlong) — 2012
Thesis: *Regional Moment Tensors from the 2010-2012 Canterbury Earthquake Sequence, South Island, New Zealand*

Amherst College
B.A. Geology and Physics (double major), Magna cum laude (GPA: 3.87/4.00) (Advisor: John Cheney) — 2009
Thesis: *P-T Paths of Biotite-Sillimanite-Garnet Gneisses from the Highland Mountains, Southwest Montana*

Peer-Reviewed Publications

Herman, M.W., Furlong, K.P. (2021). Triggering an unexpected earthquake in an uncoupled subduction zone. *Science Advances* 7, 13, eabf7590.

McKenzie, K.A., Furlong, K.P., **Herman, M.W.** (2020). Bi-directional loading of the subduction interface: Evidence from kinematics of slow slip events. *Geochemistry, Geophysics, Geosystems* 21, e2020GC008918.

Herman, M.W., Govers, R. (2020). Locating fully locked asperities along the South America subduction megathrust: A new physical inter-seismic inversion approach in a Bayesian framework. *Geochemistry, Geophysics, Geosystems* 21, e2020GC009063.

Herman, M.W., Govers, R. (2020). Stress evolution during the megathrust earthquake cycle and its role in triggering extensional deformation in subduction zones. *Earth and Planetary Science Letters* 544, 116379.

Herman, M.W., Furlong, K.P., Govers, R. (2018). The accumulation of slip deficit in subduction zones in the absence of mechanical coupling: Implications for the behavior of megathrust earthquakes. *Journal of Geophysical Research: Solid Earth* 123, 8260-8278.

Meyers, B., **Herman, M.W.**, Furlong, K.P., Pananont, P. (2018). Evaluating the state of stress and seismic hazard in Thailand and vicinity through finite element modeling. *Journal of Asian Earth Sciences* 166, 260-269.

Kintner, J.A., Ammon, C.J., Cleveland, K.M., **Herman, M.** (2018). Rupture processes of the 2013-14 Minab earthquake sequence, Iran. *Geophysical Journal International* 213, 1898-1911.

Govers, R., Furlong, K.P., van de Wiel, L., **Herman, M.W.**, Broerse, T. (2018). The geodetic signature of the earthquake cycle at subduction zones: Model constraints on the deep processes. *Reviews of Geophysics* 56, 6-49.

Furlong, K.P., **Herman, M.** (2017). Reconciling the deformational dichotomy of the 2016 Mw 7.8 Kaikoura, New Zealand, earthquake. *Geophysical Research Letters* 44, 6788-6791. (Research Commentary)

Nealy, J.N., **Herman, M.W.**, Moore, G.L., Hayes, G.P., Benz, H.M., Bergman, E.A., Barrientos, S.E. (2017). The 2017 Valparaiso earthquake sequence and the megathrust patchwork of central Chile. *Geophysical Research Letters* 44, 8865-8872.

Pananont, P., **Herman, M.W.**, Pornsopin, P., Furlong, K., Habangkaem, S., Waldhauser, F., Wongwai, W., Limpisawad, S., Warnitchai, P., Kosuwan, S., Wechbunthung, B. (2017). Seismotectonics of the 2014 Chiang Rai, Thailand, earthquake sequence. *Journal of Geophysical Research: Solid Earth* 122, 6367-6388.

Herman, M.W., Nealy, J.L., Yeck, W.L., Barnhart, W.D., Hayes, G.P., Furlong, K.P., Benz, H.M. (2017). Integrated geophysical characteristics of the 2015 Illapel, Chile, earthquake. *Journal of Geophysical Research: Solid Earth* 122, 4691-4711.

Herman, M.W., Furlong, K.P. (2016). Revisiting the Canterbury earthquake sequence after the 14 February 2016 Mw 5.7 event. *Geophysical Research Letters* 43, 7503-7510.

Herman, M.W., Furlong, K.P., Hayes, G.P., Benz, H.M. (2016). Foreshock triggering of the 1 April 2014 Mw 8.2 Iquique, Chile, earthquake. *Earth and Planetary Science Letters* 447, 119-129.

Hayes, G.P., **Herman, M.W.**, Barnhart, W.D., Furlong, K.P., Riquelme, S., Benz, H.M., Bergman, E., Barrientos, S., Earle, P.S., Samsonov, S. (2014). Continuing megathrust earthquake potential in Chile after the 2014 Iquique earthquake. *Nature* 512, 295-298.

Herman, M.W., Herrmann, R.B., Furlong, K.P., Benz, H.M. (2014). Using regional moment tensors to constrain the kinematics and stress evolution of the 2010-2013 Canterbury earthquake sequence, South Island, New Zealand. *Tectonophysics* 633, 1-15.

Hayes, G.P., Furlong, K.P., Benz, H.M., **Herman, M.W.** (2014). Triggered aseismic slip adjacent to the 6 February 2013 Mw 8.0 Santa Cruz Islands megathrust earthquake. *Earth and Planetary Science Letters* 388, 265-272.

Grants and Awards

USGS Intergovernmental Personnel Act Detailee — 2021–Present
Assigned to collaborate with National Earthquake Information Center on seismotectonics aspects of earthquake response.

NWO User Support Programme Space Research (GO) (Co-PI) — Accepted
Fingerprinting vertical land motion from the earthquake cycle above subduction zones
Award Number: ALWGO.2019.001

NASA Graduate Earth and Space Science Fellowship — 2014–2017
From megathrust to the surface: Quantifying upper plate deformation at subduction zones throughout the earthquake cycle
Award Number: NNX14AL21H

AGU Outstanding Student Paper Award, Tectonophysics Section, Fall Meeting — 2012

The Pennsylvania State University

Graduate Student Colloquium 1st place Ph.D. (Post-Comps) Talk – 2018 Deines Lecture — Spring 2017
Graduate Student Colloquium 1st place Ph.D. (Pre-Comps) Talk — Spring 2015
Graduate Student Colloquium 1st place Master's Talk — Spring 2012
Paul D. Krynine Scholarship — Fall 2011–2016
Charles Knopf, Sr. Memorial Scholarship for Outstanding First-Year Graduate Students — Fall 2010
Chevron AGU Travel Award — Fall 2010

Student Advising

Utrecht University

Marjolein Blasweiler (B.Sc.) – with Rob Govers — 2020
Sensitivity of the Triggering Relationship of the 2019 Ridgecrest Earthquake Sequence, California, USA

Teus van Dam (B.Sc.) – with Rob Govers — 2020
Seismic Sources of the Zakynthos Earthquake of October 25, 2018 (USGS 6.8), and its Relationship to the Subsequent Displacements, Stresses and Seismicity

Fenna Houtsma (B.Sc.) – with Rob Govers — 2020
Earthquake triggering in the Puerto Rico earthquake swarm (2019 - 2020)

Nicolai Nijholt (Ph.D.) – Doctoral Examination Committee Member — 2019
STEP faults and lithosphere dynamics in the Mediterranean

Jasper Van Weers (M.Sc.) – with Hanneke Paulssen 2019
Relocating earthquakes in the Groningen region using a double-difference approach

Dagmar Bouwman (M.Sc.) – with Hanneke Paulssen 2018
Relocating seismicity from the 2017 Botswana earthquake sequence

Lucas Eskens (B.Sc.) – with Rob Govers 2018
The relation between mainshocks and subsequent aftershocks and how it fits in the seismic sequence and tectonic setting: a case study of the M7.5 earthquake, Papua New Guinea, February 25th, 2018

Jort Jansen (B.Sc.) – with Rob Govers 2018
The Mw 7.9 Gulf of Alaska earthquake: Stress distribution and earthquake interaction

The Pennsylvania State University

Mitchell Hastings (B.S.) – advised by Kevin Furlong 2017
Modeling the Stress Evolution of the Aleutian Arc Subduction Zone

Robert Drewicz (B.S.) – advised by Kevin Furlong 2013
Exploration of Geothermal Resources in the Newcastle Geothermal System of the Escalante Desert, Utah

Eric Guth (B.S.) – advised by Kevin Furlong 2013
An Assessment of Potential Earthquake Magnitudes For the North Island, NZ Subduction Zone

Professional Associations

Society of Exploration Geophysicists Pacific Coast Section	2021–Present
Seismological Society of America Member	2021–Present
Southern California Earthquake Center Member	2020–Present
Geological Society of America Member	2019–Present
European Geosciences Union Member	2018–Present
American Geophysical Union Member	2010–Present

Teaching Experience

California State University, Bakersfield

GEOL 1009: How The Earth Works
GEOL 1209: Dangerous Earth
GEOL 2010: Physical Geology

The Pennsylvania State University

Co-developer and TA – "Plate Tectonics"	Fall 2016
Co-developer and TA – "Earthquake Information Project"	2014–2015
Field Camp – "Contact Metamorphism and Cooling of the Alta Stock"	2015
Teaching Assistant – "Physical Processes in Geology"	Fall 2011, Fall 2013
Teaching Assistant – "Natural Disasters: Hollywood vs. Reality"	Spring 2013, Spring 2014
Teaching Assistant – "Geology of Climate Change"	Spring 2011
Teaching Assistant – "Geology of the National Parks"	Fall 2010

Short Courses

"Modeling Earthquake Deformation" – Kasetsart University, Bangkok, Thailand	2015
"Flexure and Heat Flow" – Chevron, Houston, Texas	2013

Online Tutorials

"Beginner's Guide to Unix"
"Beginner's Guide to Awk"
"Introduction to Generic Mapping Tools (versions 4 and 5)"
Available at: *www.matthewwherman.com/tutorials.html*.

Amherst College

Teaching Assistant – "Dynamics" Fall 2008

Teaching Assistant – "Mineralogy" Fall 2007
Teaching Assistant – "Introductory Physics II: Electromagnetism and Optics" Spring 2007
Teaching Assistant – "Principles of Geology" Fall 2006

Service to Community

European Geosciences Union
EGU General Assembly Session Convener
"Advances in understanding earthquake sequences and (a)seismic slip across scales" 2020

American Geophysical Union
Mentoring365 program for Fall Meeting abstracts 2019
Fall Meeting Outstanding Student Presentation Award Judge 2017–2019

The Pennsylvania State University
Geodynamics Seminar Coordinator 2012–2016

Referee
Earth and Planetary Science Letters, *Geophysical Research Letters*, *Journal of Geophysical Research: Solid Earth*, *New Zealand Journal of Geology and Geophysics*, *Science Advances*, *Tectonophysics*

Proposal Reviewer
Fondo Nacional de Desarrollo Científico y Tecnologico (Chile), Swiss National Science Foundation

Outreach

Real World Globes
"Magnetic Anomalies of the Ocean" (*www.realworldglobes.com*) 2019

American School of the Hague (Wassenaar, The Netherlands)
Guest Scientist April 2018, April 2019

Utrecht University
"Earthquake Cycle at Subduction Zones" (*www.youtube.com/watch?v=T1QKPoxMdGg*) June 2018

European Geosciences Union
"The Art of the 15-minute Talk" (*blogs.egu.eu/divisions/gd/2018/06/07/the-art-of-the-15-minute-talk*) 2018

Stone Valley Community Charter School (Huntingdon, PA)
Science Fair Judge March 2014

The Pennsylvania State University
"Shake, Rattle, and Rocks" January 2013

Software Development

I work with existing geodynamics and geophysics software packages in my research and also develop my own tools. I am skilled in Linux, Fortran, awk, Generic Mapping Tools (GMT), Seismic Analysis Code (SAC), and Matlab, as well as some HTML/CSS, Python, and OpenMPI.

Hdef (*github.com/mherman09/Hdef*)
Developed tools for computing fault-generated deformation in an elastic half-space. Capabilities include modeling GPS displacements, synthetic InSAR interferograms, static stress transfer, and tsunami sources. Introductory tutorials for use of *Hdef* are available at: *www.matthewwherman.com/software.html*.

GTECTON
Contributed to massively parallel finite element platform developed by Rob Govers at Utrecht University.

Scientific and Professional Development

COMET InSAR Training Workshop (University of Leeds) November 2019

Research (External to Degree Programs)

USGS National Earthquake Information Center
Graduate Student Intern — Summer 2010–2015

Kelly Services – Covidien (Webster Groves, MO)
Research & Development Group — 2009

Geophysical Institute, University of Alaska-Fairbanks
NASA Planetary Geology & Geophysics Undergraduate Research Program — 2008

Public Talks

CSUB Department of Geological Sciences Speaker Series — 15 March 2021
Seismology and Geodesy and Modeling, Oh My: New Developments and Opportunities in Seismotectonics and Geodynamics

CSUB NSME Faculty Lecture Series — 4 March 2021
Earthquakes Causing Earthquakes: Lessons for California from Triggered Earthquakes Around the World

Caltech Seismolab Seminar — 12 February 2021
The mechanics of plate interface coupling and implications for the behavior of subduction zone earthquakes

Penn State Geodynamics Seminar — 4 February 2021
The mechanics of plate interface coupling and implications for the behavior of subduction zone earthquakes

Utrecht University Seismology Seminar — 31 October 2019
Constraining Patterns of Interseismic Locking and Slip Deficit in Subduction Zones and Their Relationship to Great Earthquake Ruptures

Utrecht University Seismology Seminar — 31 January 2019
Crustal Faulting Above A Ruptured Subduction Megathrust In The 2016 Kaikoura, New Zealand, Earthquake

Penn State Geodynamics Seminar — 4 April 2018
Post-seismic Relaxation Masks Subduction Zone Locking in South America or: How I Learned to Stop Worrying and Love 3D Modeling

Penn State Deines Lecture (for best presentation at PSU Geosciences Graduate Student Colloquium) — 3 April 2018
Loading, Triggering, and Relaxing: Observations and Models of Subduction Earthquake Processes

TU Delft — 13 March 2018
Understanding Megathrust Earthquakes Through Observations and Models

Open-File Reports

Herman, M.W., Hayes, G.P., Smoczyk, G.M., Turner, R., Turner, B., Jenkins, J., Davies, S., Parker, A., Sinclair, A., Benz, H.M., Furlong, K.P., and Villasenor, A. (2015). Seismicity of the Earth 1900-2013 Mediterranean Sea and vicinity. U.S. Geological Survey Open-File Report 2010–1083-Q, scale 1:10,000,000.

Benz, H.M., **Herman, M.**, Tarr, A.C., Hayes, G.P., Furlong, K.P., Villasenor, A., Dart, R.L., and Rhea, S. (2011). Seismicity of the Earth 1900-2010 Australia Plate and Vicinity. U.S. Geological Survey Open-File Report 2010-1083-G, scale 1:15,000,000.

Benz, H.M., **Herman, M.**, Tarr, A.C., Hayes, G.P., Furlong, K.P., Villasenor, A., Dart, R.L., and Rhea, S. (2011). Seismicity of the Earth 1900-2010 New Guinea and Vicinity. U.S. Geological Survey Open-File Report 2010-1083-H, scale 1:8,000,000.

Benz, H.M., **Herman, M.**, Tarr, A.C., Furlong, K.P., Hayes, G.P., Villasenor, A., Dart, R.L., and Rhea, S. (2011). Seismicity of the Earth 1900–2010 Eastern Margin of the Australia Plate. U.S. Geological Survey Open-File Report 2010-1083-I, scale 1:8,000,000.

Conference Proceedings

In the interest of space, I only list abstracts for which I was a (co-)presenting author. A complete list of co-authored abstracts can be found at my website (*www.matthewwherman.com/publications.html*).

* Invited

2021

Herman, M.W., Furlong, K.P. Triggering an Unexpected Earthquake in an Uncoupled Subduction Zone. Abstract to be presented at 2021 SSA Annual Meeting, 19–23 Apr.

Furlong, K.P., **Herman, M.W.** Triggering an Unexpected Earthquake in an Uncoupled Subduction Zone. Abstract to be presented at 2021 EGU General Assembly ("vEGU"), 19–30 Apr.

2020

Herman, M.W., Nijholt, N., van der Wiel, L., Govers, R. (2020). A method for constraining the causes of active tectonic deformation using 2D finite element models in a Bayesian framework. Abstract G017-09A presented at 2020 AGU Fall Meeting, 1–17 Dec.

*__Herman, M.W.__, Govers, R., Furlong, K.P. (2020). Stress evolution during the megathrust earthquake cycle and its role in triggering extensional deformation in subduction zones (*Invited*). Abstract presented at 2020 GSA Connects Online, 26–30 Oct.

Herman, M.W., Govers, R., Nijholt, N., van der Wiel, L.Y. (2020). Probabilistic constraints on lithospheric forces, fault tractions, and rheology in the eastern Mediterranean region. Abstract EGU2020-18364 presented at 2020 EGU General Assembly ("Sharing Geoscience Online"), 3–8 May.

2019

Herman, M.W., Govers, R. (2019). Resolving locked asperities and slip deficit in unlocked regions: A new inversion method applied in the South America subduction zone. Abstract T051H-0359 presented at 2019 AGU Fall Meeting, San Francisco, CA, 9–13 Dec.

Govers, R., **Herman, M.W.** (2019). Causes of extensional deformation in subduction zones following megathrust earthquakes. Abstract T13H-0333 presented at 2019 AGU Fall Meeting, San Francisco, CA, 9–13 Dec.

Herman, M.W., Govers, R. (2019). The evolution of extensional deformation throughout subduction zone earthquake cycles. Geological Society of America Abstracts with Programs, vol. 51, no. 5.

Herman, M.W., Govers, R. (2019). The relationship between earthquake cycle processes and normal faulting earthquakes in subduction zones: A case study of the 2011 Tohoku earthquake. Abstract EGU2019-12766 presented at 2019 EGU General Assembly, Vienna, Austria, 7–12 Apr.

2018

Simons, W.J., Riva, R., Pietrzak, J., **Herman, M.W.**, Hooper, A.J., Vigny, C., Susilo, S., Sarsito, D.A., Sofian, S., Broerse, T., Kleptsova, O., Lhermitte, S., Nijholt, N., Shen, L., Efendi, J., Naeije, M., Bhat, H.S., Morishita, Y., Govers, R.M.A. (2018). Tsunami potential of the 2018 Sulawesi earthquake from GNSS constrained source mechanism. Abstract NH23F-3553 presented at 2018 AGU Fall Meeting, Washington, DC, 10–14 Dec.

Herman, M.W., Govers, R. (2018). Modeling the spatial and temporal evolution of normal faulting earthquakes in the upper plate of the Japan subduction zone after the 2011 Tohoku earthquake. Abstract G23C-0614 presented at 2018 AGU Fall Meeting, Washington, DC, 10–14 Dec.

Furlong, K.P., **Herman, M.W.**, Rogers, D.B. (2018). Quantifying plate tectonics in the classroom – Magnetic anomalies, Euler poles, and plate motions on a sphere. Abstract ED23C-0928 presented at 2018 AGU Fall Meeting, Washington, DC, 10–14 Dec.

Herman, M.W., Govers, R. (2018). Overprinting the signal of inter-seismic coupling on subduction megathrusts throughout the earthquake cycle. Abstract EGU2018-8003 presented at 2018 EGU General Assembly, Vienna, Austria, 8–13 Apr.

2017

Herman, M.W., Furlong, K.P., Govers, R. (2017). Implications of loading/unloading a subduction zone with a heterogeneously coupled interface. Abstract T23F-0675 presented at 2017 AGU Fall Meeting, New Orleans, LA, 11–15 Dec.

Furlong, K.P., **Herman, M.W.** (2017). Linkages between the megathrust and upper-plate deformation: Lessons from the deformational dichotomy of the 2016 Kaikoura New Zealand earthquake. Abstract T23F-0678 presented at 2017 AGU Fall Meeting, New Orleans, LA, 11–15 Dec.

2016

Herman, M.W., Govers, R., Furlong, K.P. (2016). Constraining interseismic deformation processes in subduction zones through simple mechanical models. Abstract T13A-2669 presented at 2016 Fall Meeting, AGU, San Francisco, CA, 12–16 Dec.

2015

Herman, M.W., Furlong, K.P., Hayes, G.P., Benz, H.M. (2015). Foreshock (and slow slip?) triggering of the 1 April 2014 Mw 8.2 Iquique, Chile, earthquake. Abstract T41D-01 presented at 2015 Fall Meeting, AGU, San Francisco, CA, 14–18 Dec.

Herman, M.W., Yeck, W., Nealy, J., Hayes, G.P., Barnhart, W., Benz, H.M., Furlong, K.P. (2015). Integrated geophysical characteristics of the 2015 Illapel, Chile, earthquake. Abstract S54C-04 presented at 2015 Fall Meeting, AGU, San Francisco, CA, 14–18 Dec.

2014

Herman, M., Furlong, K., Hayes, G., Benz, H. (2014). Assessing the utility of strong motion data to determine static ground displacements during great megathrust earthquakes: Tohoku and Iquique. Abstract S31D-4449 presented at 2014 Fall Meeting, AGU, San Francisco, CA, 15–19 Dec.

2013

Herman, M.W., Furlong, K.P., Hayes, G. (2013). Constraining the static deformation process of the great 2011 Tohoku earthquake using high rate GPS. Abstract S43A-2496 presented at 2013 Fall Meeting, AGU, San Francisco, CA, 9–13 Dec.

2012

Herman, M.W., Furlong, K.P., Herrmann, R.B., Benz, H. (2012). Using regional moment tensors to constrain kinematics and stress evolution during the 2010-2012 Canterbury, New Zealand, earthquake sequence. Abstract T33A-2644 presented at 2012 Fall Meeting, AGU, San Francisco, CA, 3–7 Dec.

2011

Herman, M.W., Furlong, K.P., Herrmann, R.B., Benz, H. (2011). Using regional moment tensors to constrain earthquake processes following the 2010 Darfield and 2011 Canterbury New Zealand earthquake sequences. Abstract S21C-07 presented at 2011 Fall Meeting, AGU, San Francisco, CA, 5–9 Dec.

2010

Herman, M.W., Furlong, K.P., Benz, H., Hayes, G.P. (2010). A comparison of transpressional boundaries: what New Zealand can tell us about tectonics in New Guinea. Abstract T13B-2195 presented at 2010 Fall Meeting, AGU, San Francisco, CA, 13–17 Dec.

2009

Herman, M.W., Cheney, J.T., Harms, T.A., (2009). Metamorphism and P-T paths of K-feldspar-garnet-sillimanite-biotite bearing rocks from the Highland Mountains, southwestern Montana. Geological Society of America Abstracts with Programs, Vol. 41, No. 3, p. 16.

2008

Herman, M.W., Chappelow, J.E., Herrick, R.R. (2008). New crater depth data for Mercury derived from MESSENGER Flyby 1 Imagery. Eos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract U21A-0013.