

Jeong-Ung Woo, PhD

Observational Seismologist

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Google scholar link: <https://scholar.google.com/citations?user=4UTnOHcAAAAJ&hl=en>

EDUCATION

PhD, Seismology, Seoul National University, Seoul, South Korea 2015–2020
Seismic source analysis with multi-faceted approaches (Advisor: Junkee Rhie)

BS, Earth and Environmental Sciences & Mathematical Sciences, Seoul National University, Seoul, South Korea 2011–2015
Graduated with honors (*Cum laude*; Advisor: Jinho Ahn)

GRANT

PI for Basic Research Program of the National Research Foundation of Korea FY22
Implementation of GPU parallel computation on source analysis of induced and natural earthquakes

PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate, Los Alamos National Laboratory, NM (PI: Ting Chen)
Oct 2023–Current

- Identified unreported mantle earthquakes in Wyoming with developed deep-learning earthquake catalog, evidencing earthquake ruptures in ductile regime
- Developed a deep-learning earthquake catalog of New Mexico, reconciling swarm-like seismic activity and continuing induced earthquakes
- Examined the performance of nodal seismic array deployed in Pawnee, Oklahoma and quantitatively confirmed the improved performance on source characterization
- Developed a matched field processing tools using GPU processor designed for large volumed distributed acoustic sensing data to capture fluid noises originated from the micro-fracture network
- Investigated the de-amplification caused by attenuation for accurate focal mechanism estimation based on P/S ratio method

Postdoctoral Scholar, Stanford University, CA (PI: William L. Ellsworth) 2021–2023

- Reported deep-waste water disposals as the causal factor for recent increased seismic activity in Midland Basin, West Texas and southeast New Mexico
- Modified the existing seismic analysis software (HYPOELLIPSE and HypoDD) to locate earthquakes using borehole seismic data

- Detected and labeled 1.3M explosions in South Korea based by developing a deep-learning earthquake catalog and temporal changes in satellite images

Postdoctoral Scholar, Seoul National University (PI: Junkee Rhie) 2020–2021

- Designed a software to associate seismic phase arrivals based on grid-search method
- Modeled complex fault rupture scenarios for 2017 Mw 5.5 Pohang earthquake using seismic and geodetic data

PhD Candidate & Alternative Military Service (Technical Research Personnel) 2018–2021

- Revealed that 2017 Mw 5.5 Pohang earthquake was triggered by fluid stimulation at nearby enhanced geothermal system via comprehensive seismological studies
- Developed aftershock catalog for 2016 ML 5.8 Gyeongju earthquake using temporary seismic stations and imaged 3 fault planes responsible for the largest earthquakes

PhD Student 2015-2018

- Streamlined the procedure for analyzing microseismic earthquakes from seismic data of densely deployed sensors at shale gas developing site at British Columbia, Canada

Research Intern, Seoul National University 2011-2015

- Developed a 1-D reference seismic velocity model for South Korea using Bayesian waveform inversion
- Investigated shear-wave anisotropy beneath Jeju Island using shear wave splitting

TECHNICAL EXPERIENCE

Seismic instrumentation

- Installation, operation and data acquisition with broadband and geophone seismic sensors

Seismic softwares

- Earthquake detection (PhaseNet, Match&Loc, and FAST)
- Earthquake association and location (Hypoinverse, Hypoellipse, Nonlinloc and HypoDD)
- Focal mechanisms and moment tensor analysis (FPFIT, FOCMEC, HASH, ISOLA, and gCAP)
- Seismogram simulation (FK, AXITRA, SPECFEM3D cartesian)
- Visualization tool (GMT, MATLAB, Tecplot)

Computer languages

- C, Fortran, Python, MATLAB, Shell scripting

TEACHING ASSISTANTSHIPS

- “*Earthquake rupture dynamics*”, Graduate level, Geophysics department, Stanford University
2021 Fall
- “*Seismology and Geodynamics*”, 400 level, Earth and Environmental Sciences department,
Seoul National University 2015–2017

MENTORING EXPERIENCE

- Mahedi Hasan, “*Developing Deep Learning models for Generalizable Discrimination Between Earthquakes and Explosions*”
2025 Spring
- Yurong Zhang, “*Characterizing Fault Zones in the Pawnee Area Using 3D Body Wave Tomography*”
2024 Summer

PUBLICATIONS

21. (In prep.) **Jeong-Ung Woo**, and Justin Rubinstein. Evaluation of induced seismicity in the northern part of Delaware Basin, Southeast New Mexico.
20. (In prep.) **Jeong-Ung Woo**, Yongsoo Park, and William L. Ellsworth. Deep learning-based detection of explosions and earthquakes in South Korea. (Highlighted in: <https://www.seismosoc.org/news/separating-mining-explosions-from-earthquakes-in-south-korea/>)
19. (In prep.) **Jeong-Ung Woo**, Ting Chen. Deep Learning Event Catalog for New Mexico Using USArray (2007-2010): Insights into Intraplate Seismicity.
18. (In prep.) **Jeong-Ung Woo**, Jacob I. Walter, Xiaowei Chen, and Ting Chen. Microseismic monitoring using a temporary seismic array in Pawnee, Oklahoma.
17. **Jeong-Ung Woo**, and Ting Chen (2025). Mantle Earthquakes: Deep Quakes Beneath the Moho in the Wind River Basin, Wyoming. *The Seismic Record* (In review).
16. **Jeong-Ung Woo**, and Ting Chen (2025). Crustal Seismicity Across the Wyoming Craton: Earthquakes Extending to the Moho Along Laramide Structures. *Journal of Geophysical Research - Solid Earth* (In review).
15. **Jeong-Ung Woo**, and William L. Ellsworth (2023). Reactivation of Precambrian Faults by Deep Wastewater Injection in Midland Basin, Texas, and Performance Evaluation of Seismic Response Areas. *Bulletin of the Seismological Society of America*, 113(6), 2543–2566.
14. Ryan Schultz, **Jeong-Ung Woo**, Karissa Pepin, William L. Ellsworth, Howard Zebkar, Paul Segall, Yu Jeffrey Gu, and Sergey Samsonov (2023). Disposal from in situ bitumen recovery induced the ML 5.6 Peace River earthquake. *Geophysical Research Letters*, 50(6), e2023GL102940.
13. Sungho Lee, **Jeong-Ung Woo**, and Junkee Rhie (2023). Classification of transient triggering mechanisms of aftershocks in the postseismic phase of the 2017 Pohang earthquake, South Korea. *Geophysical Journal International*, 233(3), 2215–2232.

12. Eunbyeol Cho, **Jeong-Ung Woo**, and Junkee Rhie, Tae-Seob Kang, and So-Young Baag (2022). Rupture process of the 2017 Mw 5.5 Pohang, South Korea earthquake via an empirical Green's function method. *Bulletin of the Seismological Society of America*, 113(2), 592–603.
11. Yunsun Jung, **Jeong-Ung Woo**, and Junkee Rhie (2022). Enhanced hypocenter determination of the 2017 Pohang earthquake sequence, South Korea, using a 3-D velocity model. *Geosciences Journal*, 1–13.
10. Dugin Kaown, Kang-Kun Lee, Jaeyeon Kim, **Jeong-Ung Woo**, Sanghoon Lee, In-Woo Park, Daeha Lee, Jin-Yong Lee, Heejung Kim, Shemin Ge and In-Wook Yeo (2021). Earthquakes and very deep groundwater perturbation mutually induced, *Scientific Reports*, 11(1), 1–13.
9. **Jeong-Ung Woo**, Minook Kim, Junkee Rhie, and Tae-Seob Kang (2020). Aftershock sequence and statistics of Mw 5.5 Pohang earthquake, South Korea: Implication of fault heterogeneity and post-seismic relaxation, *Bulletin of the Seismological Society of America*, 110(5), 2031–2046.
8. Cornelius Langenbruch, William L. Ellsworth, **Jeong-Ung Woo**, and David J. Wald (2020). Value at induced risk: Injection-induced seismic risk from low-probability, high-impact events. *Geophysical Research Letters*, 47(2), e2019GL085878.
7. **Jeong-Ung Woo**, Minook Kim, Dong-Hoon Sheen, Tae-Seob Kang, Junkee Rhie, Francesco Grigoli, William L. Ellsworth, and Domenico Giardini (2019). An in-depth seismological analysis revealing a causal link between the 2017 Mw 5.5 Pohang earthquake and EGS project, *Journal of Geophysical Research - Solid Earth*, 124(12), 13060–13078.
6. Kang-Kun Lee, William L. Ellsworth, Domenico Giardini, John Townend, Shemin Ge, Toshihiko Shimamoto, In-Wook Yeo, Tae-Seob Kang, Junkee Rhie, Dong-Hoon Sheen, Chandong Chang, **Jeong-Ung Woo**, and Cornelius Langenbruch, Managing injection-induced seismic risks, *Science*, 364(6442), 730–732.
5. **Jeong-Ung Woo**, Junkee Rhie, Seongryong Kim, Tae-Seob Kang, Kwang-Hee Kim, and YoungHee Kim, The 2016 Gyeongju earthquake sequence revisited: Aftershock interactions within a complex fault system, *Geophysical Journal International*, 217(1), 58–74.
4. Juhwan Kim, **Jeong-Ung Woo**, Junkee Rhie, and Tae-Seob Kang (2017). Automatic determination of first-motion polarity and its application to focal mechanism analysis of microseismic events. *Geosciences Journal*, 21(5), 695–702.
3. **Jeong-Ung Woo**, Juhwan Kim, Junkee Rhie, and Tae-Seob Kang (2017). Characteristics in hypocenters of microseismic events due to hydraulic fracturing and natural faults: A case study in the Horn River Basin, Canada. *Geosciences Journal*, 21(5), 683–694.
2. Kwang-Hee Kim, Tae-Seob Kang, Junkee Rhie, YoungHee Kim, Yongcheol Park, Su Young Kang, Minhui Han, Jeongmu Kim, Jechan Park, Minook Kim, ChangHwan Kong, Dabeen Heo, Heekyoung Lee, Euna Park, Hyejin Park, Sang-Jun Lee, Sungwon Cho, **Jeong-Ung Woo**, Sang-Hyun Lee, and Juhwan Kim (2016). The 12 September 2016 Gyeongju

earthquakes: 2. Temporary seismic network for monitoring aftershocks. *Geosciences Journal*, 20(6), 753–757.

1. **Jeong-Ung Woo**, Junkee Rhie, and Tae-Seob Kang (2016). Performance Test of Hypocenter Determination Methods under the Assumption of Inaccurate Velocity Models: A case of surface microseismic monitoring (in Korean). *Geophysics and Geophysical Exploration*, 19(1), 1–10.

TALK INVITATION

7. Jeong-Ung Woo, Yongsoo Park, and William L. Ellsworth (2023). Deep Learning-based Detection of Explosions and Earthquakes in South Korea. Invited talk at University of Utah.
6. Jeong-Ung Woo, Yongsoo Park, and William L. Ellsworth (2023). Deep Learning-based Detection of Explosions and Earthquakes in South Korea. Invited talk at Southern Methodist University.
5. Jeong-Ung Woo, and William L. Ellsworth (2022). Deep Learning-based Detection of Explosions and Earthquakes in South Korea. Invited talk at Lawrence Livermore National Laboratory.
4. Jeong-Ung Woo, and William L. Ellsworth (2023). Fluid-injection induced seismicity in Midland Basin, Western Texas. Invited talk at Georgia Institute of Technology.
3. Jeong-Ung Woo (2022). Induced and Triggered seismicity in Pohang, South Korea, and Midland basin, Texas. USGS induced seismicity project meeting.
2. Jeong-Ung Woo (2021). Adaptive association of seismic phases using GPGPU. Invited talk at KIGAM.
1. Jeong-Ung Woo (2020). Adaptive association of detected seismic phases using GPGPU. Invited talk at PKNU.

SELETED CONFERENCE PRESENTATIONS

29. Jeong-Ung Woo, Ting Chen, and Andrew Delorey (2025). Attenuation correction of P and S amplitudes for enhanced accuracy in focal mechanism solutions. 2025 AGU fall meeting (submitted).
28. Jeong-Ung Woo, Ting Chen, and Xiaowei Chen (2025). Microseismic monitoring using a temporary seismic array in Pawnee, Oklahoma. International Meeting for Applied Geoscience & Energy 2025.
27. Jeong-Ung Woo, and Ting Chen (2025). Deep Quakes Beneath the Moho: Insights from the Wind River Basin. 2025 SSA annual meeting.
26. Jeong-Ung Woo, and Ting Chen (2024). Deep earthquakes in the continental lithosphere. 2024 AGU fall meeting.
25. Jeong-Ung Woo, and Ting Chen (2024). Exploring Fault Mechanisms through Borehole Seismic Monitoring: A Case Study at Decatur CO2 Injection Site. SEG/SPE Induced seismicity workshop.

24. Jeong-Ung Woo, and Ting Chen (2024). Focal Mechanisms of Microseismicity at the Decatur, Illinois, CCS Site Inverted From Multiple Borehole Seismic Arrays. 2024 SSA annual meeting.
23. Jeong-Ung Woo, Ting Chen, and Andrew Delorey (2024). Enhancing Microseismic Monitoring with Machine Learning for Multiple Borehole Sensors: A Case Study of Illinois Basin Decatur Site. 2024 CCUS meeting.
22. Jeong-Ung Woo, Yongsoo Park, and William L. Ellsworth (2023). Deep learning-based detection of explosions and earthquakes in South Korea. 2023 AGU fall meeting.
21. Jeong-Ung Woo, and Justin Rubinstein (2023). Seismicity of the southern New Mexico portion of the Delaware Basin. 2023 SCITS meeting.
20. Jeong-Ung Woo (2023). Assessing the effectiveness of the SRAs following the Stanton and Range Hill earthquakes, 2023 SCITS meeting.
19. Jeong-Ung Woo, and William L. Ellsworth (2023). 2022 MW5.0 Range Hill earthquake, Midland Basin; reactivation of Precambrian fault within Midland Basin, 2023 SCEC meeting.
18. Jeong-Ung Woo, Yongsoo Park, and William L. Ellsworth (2022). Deep Learning-based Detection of Explosions and Earthquakes in South Korea. 2023 SSA annual meeting.
17. Jeong-Ung Woo, and William L. Ellsworth (2022). The role of ongoing industrial operations in the triggering of the Stanton, Texas earthquakes. 2022 AGU fall meeting.
16. Jeong-Ung Woo (2022). Midland Basin Seismicity and Seismic Response Areas. 2022 SCITS meeting.
15. Jeong-Ung Woo and William L. Ellsworth (2022). Investigation of Elastic Responses of Fluid Interactions to Stanton Earthquake Sequence. 2022 SCITS meeting.
14. Jeong-Ung Woo and William L. Ellsworth (2022). Detection of seismic activity in South Korea using Machine learning. 2022 SCEC meeting.
13. Jeong-Ung Woo and William L. Ellsworth (2022). Examination of the recent magnitude 4 earthquakes near Stanton, Texas. SEG/SPE Induced seismicity workshop.
12. Jeong-Ung Woo and William L. Ellsworth (2022). Investigation of the Induced Earthquake Sequence Near Stanton, Texas. 2022 SSA annual meeting.
11. Jeong-Ung Woo, Ankush Singh, and William L. Ellsworth (2021). Induced seismicity in the Midland Basin, Texas: application of surface and borehole seismic data to precision earthquake location. 2021 AGU fall meeting.
10. Jeong-Ung Woo, William L. Ellsworth, and Ankush Singh (2021). 2020 M4 Stanton Texas, Earthquake Sequence: determination of earthquake location with bore seismic data. 2021 SCITS meeting.
9. Jeong-Ung Woo (2021). Kinematic rupture model for the 2017 MW 5.5 Pohang, South Korea, earthquake. 2021 SCEC meeting.
8. Jeong-Ung Woo, Junkee Rhie (2020). Finite fault modeling of the MW 5.5 2017 Pohang earthquake with multi-segmented fault system. 2020 AGU fall meeting.
7. Jeong-Ung Woo, Minook Kim, Dong-Hoon Sheen, Tae-Seob Kang, Junkee Rhie, Francesco

- Grigoli, William L. Ellsworth, and Domenico Giardini (2019). High-resolution analysis on seismic source characteristics of earthquakes near Pohang enhanced geothermal system. 2019 AGU fall meeting.
6. Jeong-Ung Woo, Junkee Rhie, Seongryong Kim (2019). Source properties of repeating earthquakes in aftershocks of the 2016 ML 5.8 Gyeongju earthquake sequences. 2019 SSA annual meeting.
 5. Jeong-Ung Woo, Junkee Rhie, Seongryong Kim, and Yunsun Jung (2018). Repeating earthquakes observed in aftershocks of the 2016 ML 5.8 Gyeongju intraplate earthquake sequences. 2018 AGU fall meeting.
 4. Jeong-Ung Woo, Junghun Song, Seongryong Kim, Junkee Rhie, and Tae-Seob Kang (2018). The November 15, 2017, Pohang Earthquake Sequences: Hypocenter Distribution and Focal Mechanism Analysis. 2018 AOGS meeting.
 3. Jeong-Ung Woo, Junkee Rhie, Tae-Seob Kang, Seongryong Kim, Gyeongdon Chai, and Eunbyeol Cho (2017). High-precision relocation for aftershocks of the 2016 ML 5.8 Gyeongju earthquake in South Korea: Stress partitioning controlled by complex fault systems. 2017 AGU fall meeting.
 2. Jeong-Ung Woo, Ju Hwan Kim, Junkee Rhie, and Tae-Seob Kang (2016). Hypocenter relocation of microseismic events using a 3-D velocity model of the shale-gas production site in the Horn River Basin. 2016 AGU fall meeting.
 1. Jeong-Ung Woo, Junkee Rhie, and Ju Hwan Kim (2015). Comparison of hypocenters and their uncertainties determined by three location methods: A case study on hydro-fracturing microseismic events recorded at a dense sub-surface array. 2015 AGU fall meeting.