

**Source properties of micro to small earthquakes in the Seoul metropolitan area
and their implications for seismic hazard potentials**

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Numerous historical records present seismic damages in the Korean Peninsula that belongs to a stable intraplate region with a low frequency of earthquakes and long recurrence interval. The 2011 M_w 9.0 Tohoku-Oki megathrust earthquake affected the seismicity in the Korean Peninsula. Recent devastating earthquakes including the 2016 M_L 5.8 Gyeongju earthquake and the 2017 M_L 5.4 Pohang earthquake raised public concerns greatly on possible seismic damages in the future. Quaternary faults including Chugaryeong fault, Wangsukcheon fault, and Pocheon fault run across the Seoul metropolitan area, leaving about half of Korean population exposed to seismic hazards. In particular, the fault planes are hardly exposed on the surface, causing difficulty in seismic hazard assessment. However, studies on the fault structures and seismic activity of subsurface faults have been limitedly conducted. Temporal seismic stations were deployed densely in the Seoul metropolitan area since September 2018, allowing us to study the seismicity and subsurface structures in the area. We analyze the focal mechanism solutions of 64 earthquakes with magnitudes of $\leq M_L$ 3.8 around the fault zone since 2004 using the seismic phase polarities and S/P amplitude ratios. The focal mechanism solutions represent the geometry of fault structure and motion sense. We search micro to small earthquakes in Seoul by assessing the seismic energy at the expected P and S arrival times for assumed locations and origin times. The seismic energy is assessed using a STA/LTA algorithm that is based on signal-to-noise average amplitude ratio. We detected 37 small-size earthquakes in Seoul in January 2019 to April 2021 using seismic records from 44 stations. The strike-slip focal mechanism solutions with strikes of nodal planes range between $N20^\circ E$ and $N45^\circ E$, which are subparallel to the fault traces on the surface, are dominant. The reported and detected seismicity is primarily distributed in the northwestern part of Seoul. The properties of additionally analyzed focal mechanism solutions in the region are similar to the background tendency. This study may provide basic information on the faults and seismicity in the region for seismic hazard mitigation and seismic design.