Probabilistic Seismic Hazard Analysis using by enhanced input parameters relating to earthquake datasets, seismo-tectonic zonation, and ground motion in Korea

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Earthquakes in and around the Korean Peninsula are rather small in size with infrequent occurrence and show rather diffuse distribution, which are typical characteristics of intraplate events. Probabilistic Seismic Hazard Maps (PSHM) in Korea were made publicly since 1997 but had to include basic problems such as incompleteness of earthquake catalogs, because of the limitation of research period and essential input data.

Firstly all available earthquake information was continuously gathered from Korean and neighboring country's existing catalogs, ancient documents, papers, newspaper, etc. To prepare a consistent historical earthquake catalog, standard criteria was established to infer intensity and epicenters from the descriptions in ancient documents, such as damage degree of human, animal and architecture, natural phenomena, size of felt area, etc. These criteria and dataset were confirmed by specialist committee. Historical earthquake catalog was consisted of 1,606 events from AD 2 to 1895 and maximum MMI intensity was VIII∼IX. Because instrumental observation in Korea was done 1905∼1943 and 1978∼present, catalog of this blank period was implemented by other country and organization catalogs. Instrumental earthquake catalog was consisted of 10,184 events from AD 1889 to 2017 and the biggest instrumental earthquake on land was 1952 Pyeongyang earthquake (Mw 6.2).

It is hard to identify seismic source zone in the intraplate region. There is no unique formal procedure for seismic source models. So the K-means cluster analysis method was applied to seismic dataset to delineate seismo-tectonic model for the Korean Peninsula. The number of clusters K determined by KL index and Elbow methods appeared to be five and nine, respectively. A seismo-tectonic model composed of five source zones were developed and an alternative model with nine zones was also proposed. Also seismicity parameters were estimated in each zone.

Because there was no relative large instrumental earthquake more than magnitude 5.5 in Korea, the proper attenuation equations, which were derived from the directly observed seismic data, were not suggested. But Kyeongju EQ. (2016, Mw 5.8) and Pohang EQ. (2017, Mw 5.4) were recently occurred on land and were well recorded throughout the Korean Peninsula, including stations closing to origins especially. Modified attenuation equations suggested by using these observed data.