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## Effect of Combining Catalogs with Different Completeness

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In most seismic studies, we prefer the earthquake catalog that covers a larger region and/or a longer period. We usually combine two or more catalogs to achieve this goal. When combining catalogs, however, care must be taken because their completeness is not identical so that unexpected flaws may be caused.

We tested the effect of combining inhomogeneous catalogs using the catalog of Korea Meteorological Administration (KMA). In fact, KMA provides a single catalog containing the earthquakes occurred in and around the whole Korean Peninsula. Like the other seismic networks, however, the configuration of the KMA seismic network is not uniform over its target monitoring region, so is the earthquake detection capability. The network is denser in the land than in the off-shore. Moreover, there are no seismic information available from North Korea. Based on these, we divided the KMA catalog into three sub-catalogs; SL, NL, and AO catalogs. The SL catalog contains the earthquakes occurred in the land of South Korea while the NL catalog contains those in the land of North Korea. The AO catalog contains all earthquakes occurred in the off-shore surrounding the peninsula.

The completeness of a catalog is expressed in terms of  $m_c$ , the minimum magnitude above which no earthquakes are missing. We used the Chi-square algorithm by Noh (2017) to estimate the  $m_c$ . It turned out, as expected, that the  $m_c$  of the SL is the smallest among the three. Those of NL and AO are comparable. The  $m_c$  of the catalog combining the SL and AO is larger than those of individual catalogs before combining. The  $m_c$  is largest when combining all the three. If one needs more complete catalog, he or she had better divide the catalog into smaller ones based on the spatiotemporal detectability of the seismic network. Or, one may combine several catalogs to cover a larger region or a longer period at the expense of catalog completeness.