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Earthquake Cluster Analysis with Nearest Neighbor Approach in Taiwan

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Spatiotemporal evolution of earthquake clusters can give insights into fault geometry, triggering process, and potential interaction with fluid and heat. Taiwan is one of the most active orogenic belts with high deformation rate and complex crustal structures, so it is expected to observe seismicity driven by varying mechanisms among different geological processes. For investigating the tectonic complexity and the triggering processes of seismicity in Taiwan, a high-quality and robust catalog of earthquake clusters is critical. This study collected a long-term-effort earthquake catalog from the Central Weather Bureau from 1990/01 to 2018/06 and produced the earthquake cluster and background seismicity catalogs by four different declustering methods. Among which, the statistics-based nearest neighbor approach (NNA) performs most desirably for passing the Poisson process statistic tests while also remaining more events. We further classified the extracted earthquake clusters into the typical mainshock-aftershock (M-A) sequences and the swarms. Most of the M-A sequences are distributed near the Western Foothill. The asperity sizes, duration, and cluster event numbers all show positive correlations with mainshock magnitude. In contrast, the swarms are mainly distributed in the northern and southern Central Range and the northern Hualien regions. The lower correlation of the asperity sizes, duration, and swarm event numbers with the mainshock magnitude is showed in swarms. Moreover, we find that some of the swarm may be driven by fluid diffusion and spatial correlated with the high heat flow and spring regions.