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Assessment of seismic characteristics in the Heping-Nan'ao Region, Eastern Taiwan

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Taiwan is located on the convergent boundaries between the Philippine Sea Plate and the Eurasian Plate, where the ~8-cm/year northwestward convergence rate were accommodated by subduction offshore and collisional orogeny on land, also called as “Ring of Fire” around the Pacific Ocean. According to the complex tectonic structure of collision and subduction, Taiwan is recognized as a highly active seismic region.

To comprehend the structural characteristics and seismicity along the northeastern plate boundary of Taiwan, this study utilized data from 25 regional seismic observation stations. The dense seismic network successfully identified a total of 26,681 seismic events during the nearly 4-year observation period from 2019 to 2023. Statistical analysis of the earthquake catalog reveals that when the minimum complete magnitude is 1.2, the b-value is approximately 0.70. Furthermore, the b-value demonstrates a clear decreasing trend during year-by-year observations, suggesting potential changes in regional seismicity, such as dense seismic sequences from 2018 to 2021 in the northern segment of the longitudinal valley in Hualian.

Based on the observed results, the main seismic clusters can be categorized into three areas: the coastal areas of Heping-Nan'ao on the eastern side, the western side of observation area, and the northern side of the Yuantoushan granite. The results also indicate the presence of an aseismic zone between the first and second clusters. By utilizing the distribution of seismic source clusters, potential linear structural lines in the Heping-Nan'ao region have been estimated. The primary features closely align with existing fault trends and the distribution of surface granite bodies. In the southern segment, linear structures are situated within the convergence zone between the Coastal Range and the Central Ridge, while in the northern section, there is a distinct clockwise rotation, indicating the structural characteristics of the northward subduction of the Philippine Sea Plate. The dense seismic network offers exceptional data for evaluating regional tectonics.

Keywords: plate boundaries, seismic monitoring, velocity tomography, seismicity