

## Deep Learning Seismic Data Processing Platform and Earthquake Catalog: A Case Study of the 2022 $M_w6.9$ Chihshang Earthquake Sequence

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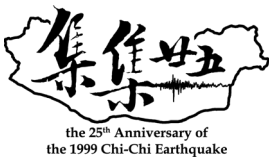
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The earthquake catalog has always been the cornerstone of seismic research, providing fundamental source information such as earthquake magnitude and distribution, focal mechanisms, and b-values. Especially after a major earthquake, creating a rapid and accurate aftershock sequence catalog is essential for understanding seismogenic structures. This information can effectively assist disaster prevention and rescue agencies in assessing damage and planning disaster relief. For example, in the case of the 2022  $M_w6.9$  Chihshang earthquake, the number of aftershocks can exceed 1,000 within a day. Relying on traditional manual processing methods would take months to complete a relatively comprehensive earthquake catalog, thereby losing the timeliness needed for effective disaster response. In recent years, the number of seismic stations across Taiwan has rapidly increased, coupled with frequent occurrences of medium to large earthquakes. The volume of earthquakes that need to be located has been piling up, requiring considerable time to process them gradually. The flourishing development of deep learning in earthquake location has provided an excellent opportunity for "appropriate applications" to efficiently and labor-savingsly complete earthquake catalogs. These "appropriate applications" involve using localized training datasets and establishing robust data quality screening processes. Localized training datasets represent the seismic wave characteristics of specific areas, enabling deep learning models to identify earthquake signals more accurately and reduce misjudgments. Additionally, establishing robust data quality screening processes can quickly filter out non-seismic signals. SeisBlue, a deep-learning-based earthquake monitoring system, is one of the solutions to deal with massive continuous waveform data and create earthquake catalogs (Kuo-Chen et al., 2022; Huang et al., 2023). The SeisBlue workflow includes waveform data preprocessing, phase arrival detection by AI modules, phase association, earthquake locating, earthquake catalog generation, and data visualization. The whole process can be done automatically and efficiently, reducing labor and time costs. Here, we present a case study of the 2022  $M_w6.9$  Chihshang earthquake sequence catalog by Sun et al. (2024). According to the results of the SeisBlue deep learning earthquake catalog, the earthquake distribution is mainly on both sides of the Longitudinal Valley, divided into the Central Range and the Coastal Range seismogenic structures.



Most of the earthquakes are distributed at depths greater than 20 kilometers. Earthquakes are not commonly seen beneath the Longitudinal Valley basin, consistent with the results of reflection seismic surveys, indicating few faults occur beneath the Longitudinal Valley (Kuo-Chen et al., 2023). Additionally, the focal mechanism solutions for the aftershock sequence are very complex, featuring various faulting mechanisms that require further analysis of the stress state for each earthquake cluster. The magnitude completeness of the earthquake catalog is ML0.8, demonstrating that the SeisBlue earthquake data processing platform, combined with the broadband seismic network data established by Academia Sinica and the MAGIC project funded by NSTC, has excellent detection capabilities for earthquakes in this region.

## REFERENCES

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