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Investigating Micro-seismicity in the Chiang Mai Basin Area, Northern Region - Thailand

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Abstract

Chiang Mai city is the largest city in northern Thailand. The city bounded by active faults, which their rate of seismicity has been poorly defined due to low coverage of seismometer. In this study, micro-seismicity around Chiang Mai Basin has been investigated. The investigation involves analyzing seismic signals from three seismic stations: CMMT, SMCM, and S1CM. The analysis period spans from February 1st, 2023, to June 30th, 2023. The initial step involved applying an STA/LTA (Short-Term Average / Long-Term Average) ratio trigger to the CMMT station's raw seismic data due to its strong signal-to-noise ratio (SNR). Then, the triggered events were manually reviewed to eliminate falsely triggered events, resulting in 153 seismic events. Of these, only 16 events exhibited signals on the other 2 stations. This is attributed to factors such as cultural noise affecting S1CM and the greater distance from earthquakes to the SMCM station, leading to weaker signals. Then, the signals from these events recorded across all three stations are used to locate earthquakes using the SEISAN program. This entailed manually picking arrival times of the P and S phases. The analysis reveals that 13 events are located in San Sai district, 2 events in Doi Saket district, and 1 event in San Kamphaeng district. Events' local magnitudes range from 0.7 to 2.3. Notably, the epicenter distribution exhibits a distinct NW-SE trend, aligning with the Huai Mae Pon fault and the Doi Sa Ket fault of the Mae Tha fault zone. However, only 3 events have epicenters on fault traces. Uncertainties were contributed by a significant azimuth gap in the eastern direction and inaccuracies in picking phases from signals with low SNR. These uncertainties could be minimized by deploying additional seismic stations in the eastern Chiang Mai area along the NW-SE direction. By increasing station density and data collection time, more events can be detected and relocated, facilitating further study of seismic source characteristics in the Chiang Mai Basin.

Keywords: micro-seismicity, relocation, STA/LTA, Chiang Mai Basin