INTISARI

PENENTUAN HIPOSENTER SINYAL GEMPA MIKRO MENGGUNAKAN FUNGSI KORELASI SILANG DI LAPANGAN PANAS BUMI "X"

Oleh

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Pemantauan gempa mikro (MEQ) merupakan aspek penting dalam pengelolaan lapangan panas bumi karena memberi informasi dini terkait pergerakan fluida geotermal dan perubahan tekanan bawah permukaan. Penentuan hiposenter gempa mikro menjadi hal krusial, namun metode konvensional yang berbasis waktu tiba gelombang *P* dan *S* sering mengalami keterbatasan karena kesulitan mengidentifikasi fasa gelombang secara jelas. Oleh karena itu, peneliti melakukan eksperimen dengan menerapkan metode *Cross-Correlation Function-based Source Scanning Algorithm* (CCF-*based* SSA) untuk menentukan hiposenter gempa mikro di lapangan panas bumi "X", Provinsi Jawa Barat. Metode ini memanfaatkan fungsi korelasi silang (CCF) yang diaplikasikan melalui proses penumpukan (*stacking*) pasangan stasiun seismik, dengan mengabaikan informasi amplitudo fisis gelombang seismik yang telah dinormalisasi dalam penentuan hiposenter.

Akurasi metode ini dievaluasi dengan membandingkan hasil penentuan hiposenter menggunakan metode CCF-*based* SSA terhadap hiposenter referensi yang diperoleh dari metode konvensional berbasis waktu tiba gelombang. Sebanyak 491 kejadian gempa mikro yang terekam pada periode Januari hingga April 2018 dianalisis dalam penelitian ini. Metode CCF-*based* SSA berhasil menentukan lokasi hiposenter dengan rata-rata misfit posisi sekitar 1–2 km pada frekuensi 1–20 Hz jika dibandingkan dengan hiposenter referensi.

Hasil penelitian ini menunjukkan bahwa metode CCF-*based* SSA memiliki potensi untuk digunakan dalam penentuan hiposenter gempa mikro di area panas bumi. Namun, metodologi ini masih memerlukan pengembangan lebih lanjut, terutama dalam kondisi ketika *picking* waktu tiba gelombang sulit dilakukan. Metode penentuan hiposenter gempa mikro yang sedang berkembang ini dapat menjadi alternatif dalam pemantauan gempa mikro, khususnya untuk menentukan hiposenter MEQ dan kejadian seismik yang tidak memiliki waktu tiba fase yang jelas.

Kata Kunci: Gempa mikro, CCF-*based* SSA, Hiposenter, Korelasi silang, Misfit.

ABSTRACT

HYPOCENTER DETERMINATION OF MICROEARTHQUAKE SIGNALS USING CROSS-CORRELATION FUNCTIONS IN "X" GEOTHERMAL FIELD

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Micro-earthquake monitoring (MEQ) is a crucial aspect of geothermal field management as it provides early information regarding geothermal fluid movement and subsurface pressure changes. Determining the micro-earthquake hypocenter is essential; however, conventional methods based on the arrival times of P and S waves often face limitations due to difficulties in clearly identifying wave phases. Therefore, the researcher conducted an experiment by applying the Cross-Correlation Function-based Source Scanning Algorithm (CCF-based SSA) method to determine the micro-earthquake hypocenter in the geothermal field "X" located in West Java Province. This method utilizes the cross-correlation function (CCF) applied through the stacking process of seismic station pairs, disregarding the normalized physical amplitude information of seismic waves in hypocenter determination.

The method's accuracy was rigorously assessed through comparative analysis between hypocenter locations determined by the Cross-Correlation Function-based Source Scanning Algorithm (CCF-based SSA) and reference hypocenters derived from the conventional P- and S-wave arrival time inversion methodology. A dataset comprising 491 microearthquake events recorded over the period from January to April 2018 was utilized for this evaluation. The CCF-based SSA method demonstrated robust performance in hypocenter localization, achieving an average spatial misfit ranging from 1 to 2 kilometers within the frequency band of 1–20 Hz when benchmarked against the reference hypocenters.

The results of this study indicate that the CCF-based SSA method has potential for application in determining micro-earthquake hypocenters in geothermal areas. However, this methodology still requires further development, particularly under conditions where picking the wave arrival times is challenging. This emerging method for micro-earthquake hypocenter determination can serve as an alternative in micro-earthquake monitoring, especially for locating MEQ hypocenters and seismic events that lack clear phase time phases arrival times.

Keywords: Microearthquake, CCF-based SSA, Hypocenter, Cross-correlation, Misfit.