

ABSTRAK

IDENTIFIKASI ZONA REKAHAN AKTIF AKIBAT PENGARUH AKTIVITAS FLUIDA PADA SUMUR INJEKSI BERDASARKAN RELOKASI HIPOSENTER GEMPA MIKRO MENGGUNAKAN METODE *DOUBLE-DIFFERENCE* DATA SEISMOGRAF PIGRAF DI LAPANGAN PANAS BUMI ULUBELU, TANGGAMUS

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Lapangan Panas Bumi Ulubelu menerapkan sistem reinjeksi fluida untuk menjaga tekanan reservoir dan keberlanjutan produksi. Aktivitas reinjeksi tersebut dapat meningkatkan tekanan pori batuan dan memicu terjadinya gempa mikro (*microearthquake/MEQ*) pada zona rekahan aktif. Penelitian ini bertujuan untuk mengidentifikasi zona rekahan aktif berdasarkan relokasi hiposenter gempa mikro menggunakan metode Double-Difference (HypoDD). Data yang digunakan merupakan data gempa mikro hasil perekaman seismograf PiGraf pada periode 17 Februari–12 April 2026 di Lapangan Panas Bumi Ulubelu. Tahapan pengolahan meliputi *picking* gelombang P dan S, penentuan hiposenter awal menggunakan *Geiger Adaptive Damping* (GAD), dan relokasi hiposenter menggunakan HypoDD. Dari 83 *event* gempa mikro yang teridentifikasi, sebanyak 70 *event* berhasil direlokasi. Hasil relokasi menunjukkan distribusi hiposenter yang lebih terfokus dibandingkan sebelum relokasi. Sebaran hiposenter terkonsentrasi pada kedalaman sekitar 0,5–1,5 km di sekitar sumur injeksi UBL-17, UBL-19, dan UBL-23. Pola distribusi gempa mikro cenderung mengikuti arah struktur dominan baratlaut–tenggara (NW–SE) dan baratdaya–timurlaut (SW–NE) yang diinterpretasikan sebagai zona rekahan aktif dan jalur migrasi fluida reservoir.

Kata kunci: Gempa Mikro, HypoDD, Relokasi Hiposenter, Zona Rekahan Aktif, Lapangan Panas Bumi Ulubelu

ABSTRACT

IDENTIFICATION OF ACTIVE FRACTURE ZONES INDUCED BY FLUID ACTIVITY AT INJECTION WELLS BASED ON MICROEARTHQUAKE HYPOCENTER RELOCATION USING THE DOUBLE-DIFFERENCE METHOD FROM PIGRAF SEISMOGRAPH DATA IN THE ULUBELU GEOTHERMAL FIELD, TANGGAMUS

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The Ulubelu Geothermal Field implements a fluid reinjection system to maintain reservoir pressure and sustain production. Reinjection activities can increase pore pressure within rocks and trigger microearthquakes (MEQ) along active fracture zones. This study aims to identify active fracture zones based on microearthquake hypocenter relocation using the Double-Difference (HypoDD) method. The data used in this study consist of microearthquake records acquired by the PiGraf seismograph during the period of February 17 to April 12, 2026, in the Ulubelu Geothermal Field. Data processing included P- and S-wave picking, initial hypocenter determination using the Geiger Adaptive Damping (GAD) method, and hypocenter relocation using HypoDD. Out of 83 identified microearthquake events, 70 events were successfully relocated. The relocation results show a more focused hypocenter distribution compared to the initial locations. The hypocenters are concentrated at depths of approximately 0.5–1.5 km around injection wells UBL-17, UBL-19, and UBL-23. The spatial distribution of microearthquakes tends to follow the dominant northwest–southeast (NW–SE) and southwest–northeast (SW–NE) structural trends, which are interpreted as active fracture zones and fluid migration pathways within the geothermal reservoir.

Keywords: Microearthquake, HypoDD, Hypocenter Relocation, Active Fracture Zone, Ulubelu Geothermal Field