

## ABSTRAK

### ANALISIS SEISMISITAS GEMPA DANGKAL BERDASARKAN PARAMETER GUTENBERG-RICHTER DAN DISTRIBUSI DENSITAS ENERGI PADA SISTEM SESAR AKTIF DI JAWA BARAT

Oleh  
Zafiiarah Anis Marhamah  
NIM: 115.220.019  
(Program Studi Sarjana Teknik Geofisika)

Provinsi Jawa Barat memiliki aktivitas seismik tinggi akibat pengaruh zona subduksi dan sesar aktif darat, sehingga berpotensi menimbulkan bahaya gempa dangkal. Risiko tersebut semakin meningkat seiring tingginya kepadatan penduduk di wilayah ini. Penelitian ini bertujuan untuk menganalisis karakteristik seismisitas gempa dangkal menggunakan Hukum Gutenberg-Richter dengan pendekatan *Maximum Likelihood Estimation* (MLE). Data yang digunakan berupa katalog gempa BMKG periode 2010-2025 dengan kedalaman  $<60$  km dan magnitudo  $3,0 \leq M \leq 5,8$ , yang menghasilkan 842 kejadian gempa independen setelah deklusterisasi. Analisis spasial dilakukan menggunakan grid  $0,1^\circ \times 0,1^\circ$  dengan pendekatan 80 kejadian gempa terdekat.

Hasil penelitian menunjukkan bahwa Sesar Cimandiri memiliki nilai *a-value* sebesar 4,817 dan *b-value* sebesar 0,97, yang mengindikasikan aktivitas seismik tinggi dengan dominasi gempa bermagnitudo kecil. Sebaliknya, Sesar Garsela memiliki nilai *a-value* sebesar 4,368 dan *b-value* sebesar 0,82, yang menunjukkan frekuensi kejadian gempa lebih rendah, namun berpotensi menghasilkan gempa dengan pelepasan energi lebih besar. Selain itu, hasil analisis indeks seismisitas menunjukkan bahwa gempa dengan magnitudo  $\geq M 5,0$  diperkirakan terjadi sekitar 2,97 kejadian gempa/tahun dengan periode ulang sekitar  $\pm 4$  bulan, sedangkan gempa dengan magnitudo  $\geq M 5,8$  diperkirakan terjadi sekitar 0,86 kejadian gempa/tahun dengan periode ulang sekitar  $\pm 1,16$  tahun. Nilai percepatan tanah maksimum tercatat mencapai sekitar 135,1 gal yang berpotensi menimbulkan kerusakan sedang. Secara keseluruhan, wilayah dengan tingkat kerawanan gempa relatif tinggi berada di Sukabumi, Cianjur, Garut, dan Sumedang, sehingga diperlukan peningkatan mitigasi dan kesiapsiagaan masyarakat terhadap potensi gempa bumi.

Kata kunci: Densitas Energi, Hukum Gutenberg–Richter, Jawa Barat, Percepatan Tanah Maksimum, Seismisitas.

## **ABSTRACT**

# ***SEISMICITY ANALYSIS OF SHALLOW EARTHQUAKES USING GUTENBERG–RICHTER PARAMETERS AND ENERGY DENSITY DISTRIBUTION IN ACTIVE FAULT SYSTEMS OF WEST JAVA***

By

Zafiirah Anis Marhamah

NIM: 115.220.019

(Geophysical Engineering Undergraduated Program)

*West Java Province has high seismic activity due to the influence of subduction zones and active faults on land, making the region prone to shallow earthquakes. This condition is further intensified by the high population density in the area. This study aims to analyze the seismicity characteristics of shallow earthquakes using the Gutenberg–Richter Law with the Maximum Likelihood Estimation (MLE) approach. The study used the BMKG earthquake catalog from 2010–2025, consisting of earthquakes with depths  $<60$  km and magnitudes of  $3.0 \leq M \leq 5.8$ . After the declustering process, 842 independent earthquake events were obtained. Spatial analysis was carried out using a  $0.1^\circ \times 0.1^\circ$  grid with an approach based on the 80 nearest earthquake events.*

*The results show that the Cimandiri Fault has an a-value of 4.817 and a b-value of 0.97, indicating high seismic activity dominated by small-magnitude earthquakes. In contrast, the Garsela Fault has an a-value of 4.368 and a b-value of 0.82, indicating a lower frequency of earthquakes but a tendency to generate larger energy release. In addition, the seismicity index analysis indicates that earthquakes with magnitudes  $\geq M 5.0$  are estimated to occur about 2.97 events per year with a recurrence interval of approximately  $\pm 4$  months, while earthquakes with magnitudes  $\geq M 5.8$  are estimated to occur about 0.86 events per year with a recurrence interval of approximately  $\pm 1.16$  years. The maximum ground acceleration reached approximately 135.1 gal, which has the potential to cause moderate damage. Overall, areas with relatively high earthquake hazard levels are located in Sukabumi, Cianjur, Garut, and Sumedang. Therefore, improved mitigation efforts and community preparedness are needed to reduce potential earthquake impacts.*

*Keywords: Energy Density, Gutenberg-Richter Law, Peak Ground Acceleration, Sismicity, West Java.*