

**PEMANTAUAN SEISMIK *AMBIENT NOISE* DAN AMPLITUDO SPEKTRAL
SEISMIK UNTUK IDENTIFIKASI PENINGKATAN AKTIVITAS GUNUNG IJEN**



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Oleh:

Fauzan Nur Elsafitri

NIM 2100100

PROGRAM STUDI FISIKA

FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
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**PEMANTAUAN SEISMIK *AMBIENT NOISE* DAN AMPLITUDO
SPEKTRAL SEISMIK UNTUK IDENTIFIKASI PENINGKATAN
AKTIVITAS GUNUNG IJEN**

Oleh:

Fauzan Nur Elsafitri

Sebuah skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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LEMBAR PENGESAHAN
FAUZAN NUR ELSAFITRI
**PEMANTAUAN SEISMIK *AMBIENT NOISE* DAN AMPLITUDO SPEKTRAL
SEISMIK UNTUK IDENTIFIKASI PENINGKATAN AKTIVITAS VULKANIK
GUNUNG IJEN**

Disetujui dan disahkan oleh:

Pembimbing I



Dr. Mirjin Iryanti, S.Si., M.Si.
NIP. 197712082001122001

Pembimbing II,

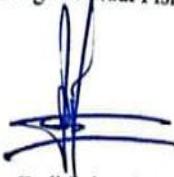


Ir. Kristianto, M.Si.

NIP. 196612191996031001

Mengetahui,

Ketua Program Studi Fisika



Prof. Dr. Endi Suhendi, M.Si.
NIP. 197905012003121001

Pemantauan Seismik *Ambient Noise* Dan Amplitudo Spektral Seismik Untuk Identifikasi Peningkatan Aktivitas Gunung Ijen

ABSTRAK

Gunung Ijen merupakan salah satu gunung api aktif di Indonesia yang memerlukan pemantauan berkelanjutan untuk mitigasi bencana. Penelitian ini bertujuan mengidentifikasi peningkatan aktivitas vulkanik Gunung Ijen melalui analisis variasi kecepatan seismik relatif ($\delta v/v$) dan pengukuran amplitudo spektral seismik (SSAM) menggunakan data dari stasiun tunggal IJEN. Metode yang digunakan meliputi autokorelasi seismik ambient noise untuk memperoleh nilai $\delta v/v$, serta analisis SSAM untuk memetakan distribusi energi seismik. Hasil penelitian menunjukkan bahwa peningkatan aktivitas vulkanik ditandai oleh penurunan nilai $\delta v/v$ sebesar -0,6% hingga -0,8%, yang bertepatan dengan periode krisis Januari 2020, Desember 2022–Januari 2023, dan Juli–Agustus 2024. Penurunan ini signifikan secara statistik berdasarkan uji *Modified Z-score* ($p < 0,05$) dan berkorelasi dengan peningkatan jumlah gempa vulkanik, tremor, serta erupsi. Analisis SSAM menunjukkan peningkatan energi seismik pada frekuensi rendah (0–5 Hz) selama periode aktivitas meningkat, yang selaras dengan kenaikan gempa Tremor dan Hembusan. Perbandingan visual $\delta v/v$ dan SSAM tidak menunjukkan kesesuaian yang konsisten pada seluruh periode krisis; hal ini mengindikasikan variasi mekanisme sumber, di mana periode tertentu didominasi proses hidrotermal dangkal dan periode lainnya dipengaruhi oleh proses magmatik dalam. Integrasi kedua metode ini memberikan pemahaman yang lebih komprehensif untuk memantau dinamika internal Gunung Ijen dan berpotensi memperkuat sistem peringatan dini erupsi.

Kata Kunci: Gunung Ijen, Seismik *Ambient Noise*, SSAM, $\delta v/v$, Aktivitas Vulkanik

Ambient Noise Seismic Monitoring and Spectral Seismic Amplitude for Identification of Increased Volcanic Activity of Ijen Volcano

ABSTRACT

Ijen Volcano is one of the active volcanoes in Indonesia that requires continuous monitoring for disaster mitigation. This study aims to identify the increase in volcanic activity of Ijen Volcano through the analysis of relative seismic velocity variations ($\delta v/v$) and Seismic Spectral Amplitude Measurement (SSAM) using data from the single IJEN station. The methods applied include seismic ambient noise autocorrelation to obtain $\delta v/v$ values and SSAM analysis to map the distribution of seismic energy. The results show that an increase in volcanic activity is marked by a decrease in $\delta v/v$ values of -0.6% to -0.8%, coinciding with crisis periods in January 2020, December 2022–January 2023, and July–August 2024. This decrease is statistically significant based on the Modified Z-score test ($p < 0.05$) and correlates with an increase in the number of volcanic earthquakes, tremors, and eruptions. SSAM analysis indicates an increase in seismic energy at low frequencies (0–5 Hz) during periods of heightened activity, which corresponds with an increase in Tremor and Emission earthquakes. Visual comparison of $\delta v/v$ and SSAM does not show consistent agreement across all crisis periods; this suggests variations in source mechanisms, with certain periods dominated by shallow hydrothermal processes and others influenced by deeper magmatic processes. The integration of these two methods provides a more comprehensive understanding of the internal dynamics of Mount Ijen and has the potential to strengthen the early warning system for eruptions.

Keywords: Ijen Volcano, Ambient Seismic Noise, SSAM, $\delta v/v$, Volcanic Activity.

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