INTISARI

IDENTIFIKASI DINAMIKA SUMBER GEMPABUMI VT DALAM (VTA) GUNUNG SINABUNG SUMATERA UTARA BERDASARKAN ANALISIS FREKUENSI SPEKTRAL

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Gempabumi Vulkano Tektonik (VT) berhubungan dengan intrusi fluida di dalam tubuh gunungapi. Frekuensi dari spektral VT mengindikasikan *stress* efektif yang berasal dari aktivitas gunungapi. Spektral ini dapat diaplikasikan untuk menentukan parameter sumber dan dinamika sumber dari gempabumi VT tersebut. Penelitian ini menganalisis spektral gempabumi VTA gunung Sinabung periode Juli-November 2013. Data penelitian dibagi menjadi 3 periode, yaitu periode sebelum erupsi (1 Juli-14 September 2013), periode saat erupsi (15-18 September 2013) dan periode setelah erupsi (19 September–30 November 2013). Analisis spektral dilakukan dengan mengaplikasikan algoritma FFT berdasarkan model Brune.

Hasil analisis menyebutkan bahwa frekuensi sudut gempabumi VTA gunung Sinabung didominasi oleh frekuensi 12-13 Hz. Hiposenter berada pada kedalaman 2 km – 20 km dari puncak. Episenter tersebar kearah Baratlaut dari puncak, menuju danau Kawar. Mekanisme sumber didominasi oleh *strike slip* dan *oblique*, dan sebagian kecil sesar normal dan sesar naik. Momen seismik, momen magnitudo dan energi yang diradiasikan berturut-turut 0.2-1.9 x 10^{12} Nm, 07-2 Mw, dan 0,1-9,5 x 10^{15} erg. Panjang *rupture* memiliki *range* 144,2-243,1 m, *slope* spektral 2,1-7.8 dB/cm, dan *stress drop* 0.1-7,6 bar. Pengumpulan energi sebelum erupsi terjadi pada periode Juli-Agustus. Rekahan yang memicu terjadinya erupsi terjadi pada 12 September 2013. Rekahan tersebut tertutup kembali pada tanggal 22 September 2013. Selama erupsi terjadi suplai magma dari pipa kepundan ke permukaan. Penimbunan energi kembali terjadi pada bulan Oktober, disertai dengan terbentuknya kubah baru yang diikuti oleh erupsi magmatik pada November 2013. Hasil-hasil tersebut mengarah pada kesimpulan bahwa, perubahan pola dari dinamika sumber gempabumi mengakibatkan perubahan karakteristik spektral dan parameter sumber gempabumi VTA.

Kata kunci: Sinabung, VT, analisis spektral, FFT, frekuensi sudut, dinamika sumber, parameter sumber

ABSTRACT

IDENTIFICATION OF SOURCE DYNAMIC OF DEEP VOLCANO-TECTONIC (VTA) EARTHQUAKE UNDERNEATH Mt. SINABUNG NORTH SUMATERA BASED ON FREQUENCY SPECTRA ANALYSIS

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Volcano-Tectonic (VT) earthquakes could be related to the movement of volcanic magma fluid inside volcanoes. Spectra frequency of VT indicates the effective *stress* of volcanic activity. These spectra parameters could be applied to determine source and the dynamics of the source of the VT earthquake. This study analyzed the spectra VTA earthquake in the Sinabung volcano between July and November 2013. Data were divided into three periods, before the eruption (July 1st to September 14th, 2013), during the eruption (September 15th to 18^{th,} 2013) and after the eruption (September 19th to November 30th, 2013). Spectra analysis was performed by applying the FFT algorithm based on the Brune model.

The results of these analysis show that the frequency of VTA earthquakes of Sinabung volcano were dominated by frequency of 12 -13 Hz. Hypocenter positions were at a depth of 2 km - 20 km from the summit. Epicenter positions were spread towards the Northwest from the summit, i.e to the lake Kawar direction. Most of the VTA source mechanisms are strike *slip* and oblique, and small portion of normal faults and reverse faults. The result of seismic moment, moment magnitude and energy radiation respectively were at 0.2 -1.9 x 10^{12} Nm, 0.7 - 2 Mw, and 0.1 - 9.5 x 10^{15} erg. The length of rupture were from 144.2 to 243.1 m, the spectra *slope* has 2.1 - 7.8 dB/cm, and *stress drop* are 0.1 - 7,6 bar. Energy accumulation before the eruption was occurred from July to August 2013. Fractures that triggered the eruption was happened on September 12nd, 2013 and this fractures closed on September 22nd, 2013. During the eruption, magma moved from dyke to the surface. The return of energy accumulation occurred in October 2013, accompanied by the formation of a new dome and followed by a magmatic eruption in November 2013. From the results of this study, it can be concluded that the source dynamics variation resulted in the changes of spectra characteristic and source patrameters of VTA earthquakes.

Keywords: Sinabung,volcano tectonic, spectra analysis, FFT, corner frequency, source dynamic, source parameter