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ULTRA LOW FREQUENCY (ULF) ELECTROMAGNETIC ANOMALOUS VARIATIONS RELATED TO EARTHQUAKES IN JAVA ISLANDS, INDONESIA

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The tectonic setting of Indonesia is very complex, because it is a meeting point of several tectonic plates: the Eurasian Plate, the Australian Plate, the Indian Plate, and the Pacific Plate. Such condition makes Indonesia become one of the most seismically active regions in the world. Therefore, to minimize such disasters, the research on the short-term earthquake (EQ) prediction is an important issue. One of the most promising approaches is the study of ultra low-frequency (ULF) electromagnetic anomalies preceding large earthquakes. ULF is the frequency range of electromagnetic wave less than 100 Hz. Because of deeper skin depth, ULF electromagnetic waves can penetrate through the Earth crust. In this paper, we focus on the frequency of 0.01 Hz band and would like to evaluate whether there is ULF geomagnetic anomalies preceding large earthquakes happened in Indonesia or not. Our group has installed the three components fluxgate magnetometer at Pelabuhan Ratu, West Java, Indonesia since September 2007. I have analyzed data from September 1, 2008 to October 31, 2010. There are twelve moderate-large earthquakes (M_{7.5}) during the analyzed period. The largest earthquake occurred during the analyzed period is M7.5 EQ (depth=57 km, epicenter distance =135 km, Sept. 2, 2009) according to Indonesian Meteorological, Climatological and Geophysical Agency (BMKG) earthquakes catalog. To clarify the ULF geomagnetic variations preceding all the earthquakes, spectral density based on Fast Fourier Transform (FFT) and wavelet transform (WT) as well as the analysis of spectral density ratio have been performed. The results of spectral density ratio analysis unveil clear enhancements before the largest EQ which occurred on Sept. 2, 2009 (M=7.5). These facts suggest that the spectral density analysis would be useful for seismo-electromagnetic study.

Keywords: ULF electromagnetic variation, Spectral density ratio analysis, Java Island earthquakes